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July 2011
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Estabrook Data Summary
Matt Fragala
to:
Kimberly Tisa
07/06/2011 04:43 PM
Cc:
"Patrick Goddard", "David MacIntosh"
Hide Details
From: "Matt Fragala" <MFragala@EHEinc.com>

To: Kimberly Tisa/R1/USEPA/US@EPA

Cc: "Patrick Goddard" <pgoddard@lexingtonma.gov>, "David MacIntosh" <DMacIntosh@eheinc.com>

History: This message has been replied to.

2 Attachments

Estabrook PCB Table - Air and Bulk.xls Memorandum 070511 (EH&E 17228).pdf

Hi Kim

Attached please find the air and bulk summary spread sheet that we spoke about yesterday and a copy of the most recent project memorandum. The purpose of the bulk sampling data was to characterize sources of PCB materials impacting the indoor air and was not intended to be a complete hazardous materials survey. We recognize that additional characterization is needed prior to classification and disposal of some of these materials.

I hope this information is helpful. Feel free to contact me if you have any questions.

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Sample Date	Sample ID	Location	Result (µg/m3) Monochloro-BPs	Dichloro-BPs	Trichloro-BPs	Tetrachloro-BPs	Pentachloro-BPs	Hexachloro-BPs	Heptachloro-BPs	Octachloro-BPs	Nonachloro-BPs	Decachloro-BPs	Total Homologs	Sample Volume	Notes
9/6/10	115012	Art	<4.20	16.3	46.2	42.0	39.7	40.3	9.33	<4.20	<4.20	<4.20	194	1190	
12/2/10	120205	Art	<5.54	<5.54	14.6	15.3	<5.54	<5.54	<5.54	<5.54	<5.54	<5.54	29.9	903	
9/6/10	115021	Basement	<5.50	20.3	66.1	51.0	57.9	31.1	<5.50	<5.50	<5.50	<5.50	227	909	Under Room 5
7/22/10	95349	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
8/25/10	114500	Field Blank	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	1000	
8/26/10	114350	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
8/27/10	114367	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
9/6/10	115023	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
9/12/10	115143	Field Blank	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	1000	Analyzed at a dilu
9/19/10	117227	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
9/27/10	117268	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
9/29/10	117283	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
11/11/10	117664	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
2/23/11	122825	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
4/21/11	124196	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
5/21/11	122876	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
6/9/11	121017	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
7/13/2011	124209	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
12/2/10	120201	Gym	<5.40	<5.40	13.2	14.4	10.1	<5.40	<5.40	<5.40	<5.40	<5.40	37.7	926	
4/21/11	124193	Gym	<4.52	<4.52	<4.52	10.3	18.2	<4.52	<4.52	<4.52	<4.52	<4.52	28.5	1107	
12/2/10	120207	Kitchen	<5.81	<5.81	34.1	32.3	<5.81	<5.81	<5.81	<5.81	<5.81	<5.81	66.4	861	
4/20/11	124182	Kitchen	<4.58	<4.58	8.30	6.79	9.01	<4.58	<4.58	<4.58	<4.58	<4.58	24.1	1092	
8/27/10	114365	Library	<3.79	38.1	151	120	100	40.4	20.1	<3.79	<3.79	<3.79	469	1321	
9/6/10	115018	Library	<4.32	15.1	64.7	58.7	29.5	18.7	9.41	<4.32	<4.32	<4.32	196	1158	
9/6/10	115019	Library	<5.34	16.0	61.9	54.0	29.8	24.7	11.1	<5.34	<5.34	<5.34	198	936	
11/24/10	120195	Library	<5.35	<5.35	28.0	35.4	41.6	19.2	10.4	<5.35	<5.35	<5.35	135	935	
5/21/11	122871	Library	<4.15	20.5	48.0	54.6	51.9	25.4	7.83	<4.15	<4.15	<4.15	208	1205	
6/9/11	121011	Library	<5.46	26.2	94.3	90.9	91.6	49.6	20.7	12.2	<5.46	<5.46	386	915	
7/13/2011	124208	Library	<4.27	20	69	67	69	31	7.3	<4.27	<4.27	<4.27	263	1171	
7/14/2011	124220	Library	<4.05	17	43	46	46	17	6.6	<4.05	<4.05	<4.05	176	1233	
9/19/10	117226	Media Blank	<5.00	11.0	35.9	34.6	19.0	19.2	8.60	<5.00	<5.00	<5.00	128	1000	
9/27/10	117267	Media Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
9/29/10	117282	Media Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
10/18/10	109997	Media Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
10/19/10	110007	Media Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	6.80	6.80	1000	
11/4/10	110012	Media Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
11/20/10	120189	Media Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
11/24/10	120200	Media Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
12/2/10	120212	Media Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	1000	
4/20/11	124178	Music	<4.73	<4.73	9.56	11.5	29.3	11.1	<4.73	<4.73	<4.73	<4.73	61.4	1057	
12/2/10	120209	Office - Art	<5.98	18.3	43.4	32.3	29.8	<5.98	<5.98	<5.98	<5.98	<5.98	124	837	
4/20/11	124184	Office - Art	<4.68	<4.68	15.3	22.7	36.1	12.2	<4.68	<4.68	<4.68	<4.68	86.2	1068	
12/2/10	120210	Office - Sandborne	<6.00	<6.00	23.3	29.5	13.0	<6.00	<6.00	<6.00	<6.00	<6.00	65.8	833	
4/20/11	124183	Office - Sandborne	<4.60	<4.60	14.4	11.4	22.5	6.99	<4.60	<4.60	<4.60	<4.60	55.3	1086	
7/22/10	105536	Outdoors	<3.79	<3.79	<3.79	<3.79	<3.79	<3.79	<3.79	<3.79	<3.79	<3.79	<3.79	1320	
8/25/10	114499	Outdoors													Not analyzed
8/26/10	114349	Outdoors	<3.87	<3.87	<3.87	<3.87	<3.87	<3.87	<3.87	<3.87	<3.87	<3.87	<3.87	1293	

8/27/10	114366	Outdoors	<3.92	<3.92	<3.92	<3.92	<3.92	<3.92	<3.92	<3.92	<3.92	<3.92	<3.92	1275	
9/6/10	115006	Outdoors	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	1191	
9/19/10	117222	Outdoors	<4.46	<4.46	<4.46	<4.46	<4.46	<4.46	<4.46	<4.46	<4.46	<4.46	<4.46	1121	
9/27/10	117257	Outdoors	<4.32	<4.32	<4.32	<4.32	<4.32	<4.32	<4.32	<4.32	<4.32	<4.32	<4.32	1156	
9/29/10	117281	Outdoors	<4.44	<4.44	<4.44	<4.44	<4.44	<4.44	<4.44	<4.44	<4.44	<4.44	<4.44	1125	
10/18/10	109987	Outdoors	<4.28	<4.28	91.6	140	97.6	42.3	15.9	<4.28	<4.28	<4.28	387	1168	
10/19/10	110006	Outdoors	<5.54	<5.54	<5.54	<5.54	<5.54	<5.54	<5.54	<5.54	<5.54	<5.54	<5.54	903	
11/4/10	110011	Outdoors	<4.58	<4.58	<4.58	<4.58	<4.58	<4.58	<4.58	<4.58	<4.58	<4.58	<4.58	1092	
11/11/10	117663	Outdoors	<4.61	<4.61	<4.61	<4.61	<4.61	<4.61	<4.61	<4.61	<4.61	<4.61	<4.61	1086	
11/20/10	120176	Outdoors	<4.08	<4.08	<4.08	<4.08	<4.08	<4.08	<4.08	<4.08	<4.08	<4.08	<4.08	1225	
11/24/10	120199	Outdoors	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	841	
12/2/10	120211	Outdoors	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	840	
2/23/11	122824	Outdoors	<4.37	<4.37	<4.37	<4.37	<4.37	<4.37	<4.37	<4.37	<4.37	<4.37	<4.37	1143	
4/20/11	124185	Outdoors	<5.30	<5.30	<5.30	<5.30	<5.30	<5.30	<5.30	<5.30	<5.30	<5.30	<5.30	944	
4/21/11	124195	Outdoors	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	941	
5/21/11	122875	Outdoors	<4.22	<4.22	4.38	<4.22	<4.22	<4.22	<4.22	<4.22	<4.22	<4.22	4.38	1186	
6/9/11	121016	Outdoors	<5.41	<5.41	<5.41	<5.41	<5.41	<5.41	<5.41	<5.41	<5.41	<5.41	<5.41	924	
7/13/2011	124204	Outdoors	<4.99	<4.99	<4.99	<4.99	<4.99	<4.99	<4.99	<4.99	<4.99	<4.99	<4.99	1003	
7/14/2011	124216	Outdoors	<4.67	<4.67	<4.67	<4.67	<4.67	<4.67	<4.67	<4.67	<4.67	<4.67	<4.67	1070	
9/28/10	117270	Psychologist Office	<4.12	21.6	73.3	55.8	64.7	29.6	7.98	<4.12	<4.12	<4.12	253	1215	
9/28/10	117272	Psychologist Office													NEA
8/26/10	114348	Room 1	<3.89	26.3	82.4	103	110	77.6	26.9	<3.89	<3.89	<3.89	426	1287	
9/6/10	115007	Room 1	<4.38	7.70	23.6	21.6	27.5	28.2	9.89	<4.38	<4.38	<4.38	118	1143	
9/19/10	117216	Room 1	<4.40	<4.40	8.88	13.3	14.3	18.6	8.36	<4.40	<4.40	<4.40	63.4	1137	Supplimental air
9/27/10	117262	Room 1	<4.51	<4.51	13.3	16.1	32.0	14.7	<4.51	<4.51	<4.51	<4.51	76.1	1108	
9/27/10	117266	Room 1	<4.98	<4.98	15.7	29.3	87.1	102	31.2	<4.98	<4.98	<4.98	265	1003	Ceiling
9/29/10	117280	Room 1	<4.42	<4.42	25.5	30.9	44.6	37.6	14.3	<4.42	<4.42	<4.42	153	1130	
10/18/10	109989	Room 1	<4.33	8.08	44.8	35.8	42.1	13.7	<4.33	<4.33	<4.33	<4.33	145	1155	UV Enclosure
10/18/10	109990	Room 1	<4.30	<4.30	20.6	26.3	37.8	22.6	<4.30	<4.30	<4.30	<4.30	108	1163	I Beam Enclosure
10/18/10	109991	Room 1	<4.23	<4.23	15.8	19.1	33.5	13.3	<4.23	<4.23	<4.23	<4.23	81.8	1181	
11/11/10	117655	Room 1	<4.43	<4.43	22.5	26.2	39.6	22.6	5.31	<4.43	<4.43	<4.43	116	1130	
2/23/11	122816	Room 1	<4.37	<4.37	26.4	32.5	46.5	32.0	8.47	<4.37	<4.37	<4.37	146	1143	
11/11/10	117659	Room 11	<4.53	<4.53	13.2	16.8	24.9	10.1	<4.53	<4.53	<4.53	<4.53	65.0	1103	
5/21/11	122862	Room 11	<4.23	10.6	20.0	22.3	48.0	43.1	9.22	<4.23	<4.23	<4.23	153	1182	
7/22/10	105533	Room 13	<3.81	9.89	128	94.4	39.0	37.7	9.82	<3.81	<3.81	<3.81	319	1314	
8/27/10	114363	Room 13	<3.93	22.2	113	111	60.3	33.5	<3.93	<3.93	<3.93	<3.93	340	1272	
9/6/10	115013	Room 13	<5.11	17.1	48.6	50.7	25.6	32.7	9.30	<5.11	<5.11	<5.11	184	979	
9/12/10	115140	Room 13	<40.7	<40.7	<40.7	<40.7	<40.7	<40.7	<40.7	<40.7	<40.7	<40.7	<40.7	1229	Analyzed at a dilu
9/19/10	117225	Room 13	<4.17	14.3	43.4	43.3	25.4	23.0	5.59	<4.17	<4.17	<4.17	155	1198	
11/11/10	117660	Room 13	<4.54	<4.54	21.2	23.4	29.4	14.7	<4.54	<4.54	<4.54	<4.54	88.8	1101	
11/11/10	117661	Room 13	<4.50	<4.50	19.3	24.1	34.8	15.7	<4.50	<4.50	<4.50	<4.50	93.7	1110	
2/23/11	122820	Room 13	<4.09	4.91	14.3	17.1	38.8	19.0	<4.09	<4.09	<4.09	<4.09	94.0	1223	
11/11/10	117662	Room 19	<4.45	<4.45	<4.45	<4.45	11.6	<4.45	<4.45	<4.45	<4.45	<4.45	11.6	1122	
5/21/11	122863	Room 19	<4.25	<4.25	32.3	20.7	47.8	25.3	5.46	<4.25	<4.25	<4.25	132	1177	
7/22/10	95350	Room 1A	<3.75	7.51	62.5	55.3	67.0	83.3	23.6	<3.75	<3.75	<3.75	299	1332	
8/26/10	114347	Room 2	<3.94	72.3	262	167	157	96.1	21.0	<3.94	<3.94	<3.94	775	1269	
9/6/10	115008	Room 2	<4.17	35.3	138	92.5	72.4	94.2	22.1	<4.17	<4.17	<4.17	455	1200	
9/12/10	115136	Room 2	<40.6	<40.6	52.0	<40.6	<40.6	<40.6	106	<40.6	<40.6	<40.6	158	1230	Analyzed at a dilu
9/19/10	117219	Room 2	<5.21	15.4	52.7	42.9	35.5	31.3	11.7	<5.21	<5.21	<5.21	189	961	No supplimental a
9/27/10	117260	Room 2	<4.52	7.23	54.1	29.3	53.9	16.5	5.51	<4.52	<4.52	<4.52	166	1107	

9/27/10	117261	Room 2	<4.49	12.8	38.2	33.7	40.0	24.7	<4.49	<4.49	<4.49	<4.49	150	1114	
9/27/10	117265	Room 2	<5.04	<5.04	26.3	44.8	87.4	76.7	38.8	13.6	<5.04	<5.04	287	992	Ceiling
9/29/10	117279	Room 2	<4.41	23.8	76.8	49.3	60.5	36.7	6.26	<4.41	<4.41	<4.41	253	1135	
10/18/10	109992	Room 2	<4.47	<4.47	18.9	11.8	22.3	<4.47	<4.47	<4.47	<4.47	<4.47	53.0	1119	Window Enclosur
10/18/10	109993	Room 2	<4.47	<4.47	19.2	12.9	19.5	<4.47	<4.47	<4.47	<4.47	<4.47	51.6	1119	
10/18/10	109994	Room 2	<4.72	19.5	62.1	63.3	58.8	41.6	28.2	<4.72	<4.72	<4.72	274	1059	Window Enclosur
10/18/10	109995	Room 2	<4.62	15.4	36.3	17.0	16.1	11.9	<4.62	<4.62	<4.62	<4.62	97.0	1083	UV Discharge
10/18/10	109996	Room 2	<4.52	<4.52	14.2	8.15	<4.52	<4.52	<4.52	<4.52	<4.52	<4.52	22.3	1107	
11/11/10	117656	Room 2	<4.24	<4.24	13.6	12.3	22.6	11.6	<4.24	<4.24	<4.24	<4.24	60.1	1178	
4/20/11	124176	Room 2	<4.70	<4.70	23.3	20.3	56.3	28.0	8.31	<4.70	<4.70	<4.70	136	1065	
7/13/2011	124203	Room 2	<4.16	22	65	67	81	61	14	<4.16	<4.16	<4.16	312	1203	
7/14/2011	124219	Room 2	<3.89	<3.89	14	4.4	13	11	<3.89	<3.89	<3.89	<3.89	43	1287	
11/20/10	120177	Room 20	<4.17	<4.17	13.6	11.4	24.2	7.93	<4.17	<4.17	<4.17	<4.17	57.1	1199	
4/21/11	124189	Room 20	<4.54	14.2	32.4	32.2	42.4	26.7	9.00	<4.54	<4.54	<4.54	157	1101	
4/21/11	124190	Room 20	<4.57	17.5	35.3	35.3	50.3	30.1	7.52	<4.57	<4.57	<4.57	175	1094	
7/13/2011	124207	Room 20	<4.07	28	106	109	167	81	23	<4.07	<4.07	<4.07	515	1230	
7/14/2011	124215	Room 20	<3.86	15	47	52	77	45	8.0	<3.86	<3.86	<3.86	244	1296	
9/19/10	117220	Room 21	<4.22	19.0	57.7	47.5	30.1	26.5	11.3	<4.22	<4.22	<4.22	193	1184	
9/6/10	115014	Room 21A	<4.32	33.4	145	118	62.8	39.6	10.7	<4.32	<4.32	<4.32	410	1156	
9/12/10	115138	Room 21A	<39.5	<39.5	<39.5	<39.5	<39.5	<39.5	<39.5	<39.5	<39.5	<39.5	<39.5	1266	Analyzed at a dilu
12/2/10	120203	Room 21A	<5.46	20.1	28.0	25.6	20.7	14.8	<5.46	<5.46	<5.46	<5.46	109	915	
12/2/10	120204	Room 21A	29.8	74.3	131	285	264	271	162	115	80.8	14.8	1E3	907	
2/23/11	122821	Room 21A	<4.40	8.14	31.1	23.4	27.7	12.8	<4.40	<4.40	<4.40	<4.40	103	1137	
11/20/10	120178	Room 21B	<4.29	<4.29	42.8	55.2	53.9	26.9	8.66	<4.29	<4.29	<4.29	188	1166	
5/21/11	122864	Room 21B	<4.23	7.22	137	174	159	66.7	21.5	<4.23	<4.23	<4.23	567	1181	
6/9/11	121013	Room 21B	<5.51	31.0	131	134	151	101	27.3	<5.51	<5.51	<5.51	576	908	
6/9/11	121014	Room 21B	<5.53	38.3	139	137	163	107	28.0	<5.53	<5.53	<5.53	612	905	
11/20/10	120179	Room 22	<4.35	<4.35	10.8	7.48	6.35	<4.35	<4.35	<4.35	<4.35	<4.35	24.6	1151	
5/21/11	122865	Room 22	<4.15	27.3	59.5	41.5	34.2	26.7	9.81	<4.15	<4.15	<4.15	199	1203	
5/21/11	122866	Room 22	<4.21	30.1	77.0	54.6	47.6	28.1	10.2	<4.21	<4.21	<4.21	248	1188	
6/9/11	121015	Room 22	<5.53	33.9	56.8	54.1	64.8	63.4	18.1	<5.53	<5.53	<5.53	291	904	
7/13/2011	124206	Room 22	<4.12	31	91	71	79	50	15	<4.12	<4.12	<4.12	337	1215	
7/14/2011	124214	Room 22	<3.80	18	44	35	44	26	9.6	<3.80	<3.80	<3.80	177	1317	
11/20/10	120180	Room 23	<4.21	<4.21	25.7	37.0	42.3	30.1	7.59	<4.21	<4.21	<4.21	142	1186	
4/20/11	124179	Room 23	<4.69	<4.69	7.85	21.1	58.3	23.2	7.21	<4.69	<4.69	<4.69	117	1066	
4/20/11	124180	Room 23	<4.71	<4.71	13.2	14.2	25.1	15.8	<4.71	<4.71	<4.71	<4.71	68.3	1061	
7/22/10	105534	Room 24	<3.74	59.4	332	119	62.6	77.9	29.9	<3.74	<3.74	<3.74	680	1336	
8/27/10	114364	Room 24	<3.90	72.7	242	119	82.0	67.7	18.0	<3.90	<3.90	<3.90	601	1281	
9/6/10	115015	Room 24	<4.31	26.9	80.4	38.2	31.3	39.3	10.0	<4.31	<4.31	<4.31	226	1159	
9/12/10	115141	Room 24	<40.7	<40.7	41.5	<40.7	<40.7	<40.7	<40.7	<40.7	<40.7	<40.7	41.5	1228	Analyzed at a dilu
9/19/10	117218	Room 24	<4.15	14.9	59.8	36.2	26.6	25.7	9.96	<4.15	<4.15	<4.15	173	1205	
11/20/10	120181	Room 24	<4.33	6.49	30.2	22.8	29.0	18.4	<4.33	<4.33	<4.33	<4.33	107	1155	
11/20/10	120182	Room 24	<4.37	8.21	26.6	20.3	31.3	17.9	<4.37	<4.37	<4.37	<4.37	105	1145	
2/23/11	122822	Room 24	<4.39	7.00	21.5	15.9	27.6	13.7	<4.39	<4.39	<4.39	<4.39	85.7	1140	
7/13/2011	124205	Room 24	<5.06	21	54	51	61	36	10	<5.06	<5.06	<5.06	233	987	
7/14/2011	124213	Room 24	<3.81	11	28	19	33	20	5.4	<3.81	<3.81	<3.81	116	1314	
11/20/10	120183	Room 25	<4.36	7.24	28.7	26.3	39.3	23.7	5.15	<4.36	<4.36	<4.36	130	1146	
4/21/11	124191	Room 25	<4.54	17.6	32.3	26.3	29.8	21.9	7.62	<4.54	<4.54	<4.54	135	1101	
9/12/10	115142	Room 26	<41.1	<41.1	<41.1	<41.1	<41.1	<41.1	<41.1	<41.1	<41.1	<41.1	<41.1	1216	Analyzed at a dilu
9/19/10	117224	Room 26	<4.19	6.29	25.5	25.2	10.1	11.7	<4.19	<4.19	<4.19	<4.19	78.8	1193	

11/24/10	120193	Room 26	<5.22	<5.22	12.2	10.7	16.2	7.52	<5.22	<5.22	<5.22	<5.22	46.6	958	
5/21/11	122867	Room 26	<4.22	<4.22	16.2	13.2	19.6	9.12	<4.22	<4.22	<4.22	<4.22	58.1	1184	
11/24/10	120194	Room 27	<5.23	<5.23	19.0	12.6	28.9	8.58	<5.23	<5.23	<5.23	<5.23	69.0	956	
5/21/11	122868	Room 27	<4.14	<4.14	9.86	<4.14	5.53	<4.14	<4.14	<4.14	<4.14	<4.14	15.4	1207	
9/29/10	117278	Room 3	<4.38	25.6	63.2	75.4	118	64.6	16.9	<4.38	<4.38	<4.38	364	1141	
10/19/10	109998	Room 3	<4.42	14.1	25.0	25.7	35.9	9.28	<4.42	<4.42	<4.42	<4.42	111	1131	
10/19/10	109999	Room 3	<4.50	<4.50	14.9	19.2	24.4	8.99	<4.50	<4.50	<4.50	<4.50	67.4	1112	I Beam
10/19/10	110000	Room 3	<4.38	<4.38	16.1	19.5	18.0	<4.38	<4.38	<4.38	<4.38	<4.38	53.7	1141	UV Discharge
11/11/10	117657	Room 3	<4.40	<4.40	22.2	23.2	38.8	25.4	<4.40	<4.40	<4.40	<4.40	110	1137	
4/21/11	124187	Room 3	<4.44	<4.44	4.49	11.1	9.24	19.4	<4.44	<4.44	<4.44	<4.44	44.3	1125	
7/22/10	105532	Room 31A	<3.79	36.3	185	124	75.0	102	39.3	<3.79	<3.79	<3.79	562	1321	
8/27/10	114361	Room 31A	<5.05	72.5	168	125	99.4	79.4	30.7	<5.05	<5.05	<5.05	575	990	
8/27/10	114362	Room 31A	<5.05	64.5	164	116	99.8	89.2	31.4	<5.05	<5.05	<5.05	565	990	
9/6/10	115016	Room 31A	11.5	30.9	93.3	83.0	80.2	68.9	27.5	23.5	25.7	<4.24	444	1179	
9/28/10	117269	Room 31A	<4.27	15.5	65.0	53.2	76.5	55.0	16.5	<4.27	<4.27	<4.27	282	1172	
9/28/10	117271	Room 31A													NEA
11/20/10	120184	Room 31A	<4.34	<4.34	16.4	20.7	30.7	21.1	4.51	<4.34	<4.34	<4.34	93.7	1153	
4/20/11	124181	Room 31A	<4.71	<4.71	16.4	20.0	31.8	21.6	7.53	<4.71	<4.71	<4.71	97.0	1062	
7/13/2011	124199	Room 31A	<4.02	<4.02	27	35	57	44	13	<4.02	<4.02	<4.02	175	1245	
7/14/2011	124212	Room 31A	<3.86	<3.86	11	15	30	17	5.2	<3.86	<3.86	<3.86	78	1296	
11/20/10	120185	Room 31B	<4.37	8.22	31.9	33.2	36.7	20.1	4.55	<4.37	<4.37	<4.37	135	1143	
4/21/11	124192	Room 31B	<4.59	<4.59	14.5	10.3	19.4	9.09	<4.59	<4.59	<4.59	<4.59	53.3	1089	
7/13/2011	124198	Room 31B	<4.04	12	32	46	55	42	15	<4.04	<4.04	<4.04	202	1239	
7/14/2011	124211	Room 31B	<3.84	<3.84	11	13	21	16	4.5	<3.84	<3.84	<3.84	65	1302	
8/25/10	114498	Room 39B	<3.10	19.3	144	121	85.3	39.9	8.91	<3.10	<3.10	<3.10	419	1290	
11/20/10	120186	Room 39B	<4.28	<4.28	15.6	16.1	19.6	12.3	<4.28	<4.28	<4.28	<4.28	63.6	1169	
5/21/11	122869	Room 39B	<4.20	<4.20	28.2	35.7	41.3	20.3	7.65	<4.20	<4.20	<4.20	133	1190	
7/13/2011	124197	Room 39B	<4.00	8.5	30	42	53	34	11	<4.00	<4.00	<4.00	179	1251	
7/14/2011	124210	Room 39B	<3.79	<3.79	9.2	12	11	13	<3.79	<3.79	<3.79	<3.79	45	1321	
7/22/10	105530	Room 39C	<3.79	7.65	115	89.4	41.2	60.3	27.8	<3.79	<3.79	<3.79	342	1320	
7/22/10	105531	Room 39C	<3.85	6.93	107	81.7	36.3	41.3	11.0	<3.85	<3.85	<3.85	284	1298	
8/25/10	114496	Room 39C	<3.09	16.5	147	119	130	66.7	15.4	<3.09	<3.09	<3.09	495	1296	
8/25/10	114497	Room 39C	<3.09	21.3	127	121	107	50.2	12.0	<3.09	<3.09	<3.09	438	1296	
9/6/10	115017	Room 39C	<4.27	14.9	71.8	72.1	38.8	34.1	13.1	<4.27	<4.27	<4.27	245	1171	
9/6/10	115022	Room 39C	<5.35	23.4	156	133	150	86.0	13.8	<5.35	<5.35	<5.35	562	934	Ceiling
9/12/10	115139	Room 39C	<40.6	<40.6	<40.6	<40.6	<40.6	<40.6	<40.6	<40.6	<40.6	<40.6	<40.6	1233	Analyzed at a dilu
9/19/10	117217	Room 39C	<4.27	5.12	24.3	24.7	21.4	17.2	7.09	<4.27	<4.27	<4.27	99.9	1171	
11/20/10	120187	Room 39C	<4.42	<4.42	26.0	34.9	40.2	23.8	<4.42	<4.42	<4.42	<4.42	125	1131	
2/23/11	122823	Room 39C	<4.42	<4.42	12.7	21.6	27.1	14.3	<4.42	<4.42	<4.42	<4.42	75.8	1131	
9/29/10	117277	Room 4	<4.37	29.3	87.3	59.8	95.3	61.5	10.9	<4.37	<4.37	<4.37	344	1144	
10/19/10	110001	Room 4	<4.36	13.7	29.4	22.2	41.8	18.2	<4.36	<4.36	<4.36	<4.36	126	1147	
10/19/10	110002	Room 4	<4.58	24.2	45.2	22.1	21.8	4.67	<4.58	<4.58	<4.58	<4.58	118	1092	Inside UV
11/4/10	110010	Room 4	<4.20	<4.20	30.7	21.1	32.5	15.0	<4.20	<4.20	5.43	<4.20	105	1190	
5/21/11	122860	Room 4	<4.20	22.8	41.7	39.0	54.0	45.9	13.0	<4.20	<4.20	<4.20	217	1191	
6/9/11	121012	Room 4	<5.51	8.83	22.9	24.5	36.5	40.6	18.7	<5.51	<5.51	<5.51	152	908	
7/13/2011	124201	Room 4	<3.98	19	52	57	95	63	20	<3.98	<3.98	<3.98	307	1257	
7/13/2011	124202	Room 4	<4.07	23	71	74	101	95	26	<4.07	<4.07	<4.07	390	1227	
7/14/2011	124218	Room 4	<3.79	15	44	44	69	50	14	<3.79	<3.79	<3.79	237	1320	
7/22/10	105535	Room 5	<3.80	15.6	119	98.7	67.2	109	48.5	<3.80	<3.80	<3.80	459	1317	
8/26/10	114346	Room 5	<3.94	60.8	239	179	148	86.7	22.9	<3.94	<3.94	<3.94	736	1269	

9/6/10	115009	Room 5	<4.35	17.4	114	81.0	49.3	45.1	13.0	<4.35	<4.35	<4.35	320	1151	
9/12/10	115137	Room 5	<40.1	<40.1	<40.1	<40.1	<40.1	<40.1	<40.1	<40.1	<40.1	<40.1	<40.1	1247	Analyzed at a dilu
9/19/10	117223	Room 5	<4.35	14.7	54.9	55.0	31.8	28.5	10.9	<4.35	<4.35	<4.35	196	1148	
9/27/10	117259	Room 5	<4.36	10.3	46.0	39.7	35.6	18.0	<4.36	<4.36	<4.36	<4.36	149	1146	
9/27/10	117264	Room 5	<6.20	<6.20	30.2	61.5	172	188	96.4	21.1	<6.20	<6.20	570	807	Ceiling
9/29/10	117275	Room 5	<4.36	18.9	62.2	48.0	49.8	30.0	<4.36	<4.36	<4.36	<4.36	209	1146	
9/29/10	117276	Room 5													NEA
10/19/10	110003	Room 5	<4.50	<4.50	19.2	15.9	24.7	7.19	<4.50	<4.50	<4.50	<4.50	67.0	1112	
10/19/10	110004	Room 5	<4.40	<4.40	20.7	18.5	18.3	7.30	<4.40	<4.40	<4.40	<4.40	64.7	1138	UV Discharge
10/19/10	110005	Room 5	<4.57	<4.57	25.0	26.3	28.9	9.78	<4.57	<4.57	<4.57	<4.57	90.0	1094	Dup
11/11/10	117658	Room 5	<4.45	<4.45	26.9	36.9	43.1	21.0	<4.45	<4.45	<4.45	<4.45	128	1125	
5/21/11	122861	Room 5	<4.20	<4.20	23.7	24.1	25.3	23.6	7.00	<4.20	<4.20	<4.20	103	1191	
7/22/10	105529	Room 6	<3.80	37.7	298	282	183	426	465	105	4.94	<3.80	2E3	1317	
8/26/10	114344	Room 6	<3.88	56.6	284	191	133	80.6	19.1	<3.88	<3.88	<3.88	764	1290	
8/26/10	114345	Room 6	<3.89	58.0	312	206	147	77.5	17.7	<3.89	<3.89	<3.89	816	1287	
9/6/10	115010	Room 6	<4.30	30.8	143	119	89.5	76.9	23.8	<4.30	<4.30	<4.30	483	1162	
9/19/10	117221	Room 6	<4.29	13.8	54.3	38.2	30.3	23.7	10.2	<4.29	<4.29	<4.29	171	1167	
9/19/10	117228	Room 6	<4.19	11.5	41.3	32.9	28.5	30.7	8.05	<4.19	<4.19	<4.19	153	1193	
9/27/10	117258	Room 6	<4.48	13.9	66.1	47.2	55.9	24.1	5.64	<4.48	<4.48	<4.48	213	1116	
9/27/10	117263	Room 6	<5.00	10.9	108	120	190	79.0	18.4	<5.00	<5.00	<5.00	526	1000	Ceiling
9/29/10	117273	Room 6	<4.42	24.5	110	91.0	92.7	51.2	14.5	<4.42	<4.42	<4.42	383	1132	
9/29/10	117274	Room 6	<4.40	20.6	95.1	78.6	75.3	51.3	14.0	<4.40	<4.40	<4.40	335	1136	
10/18/10	109988	Room 6	<4.32	14.0	60.4	40.2	49.0	18.8	<4.32	<4.32	<4.32	<4.32	182	1158	
11/4/10	110008	Room 6	<4.30	7.56	28.4	35.0	41.7	25.0	5.93	<4.30	<4.30	<4.30	144	1162	
11/4/10	110009	Room 6	<4.23	<4.23	26.9	27.3	43.8	15.2	4.77	<4.23	<4.23	<4.23	118	1181	Dup
2/23/11	122817	Room 6	<4.39	<4.39	16.7	16.0	37.8	22.3	4.84	<4.39	<4.39	<4.39	97.4	1139	
7/13/2011	124200	Room 6	<4.00	<4.00	8.8	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	8.8	1251	
7/14/2011	124217	Room 6	<3.77	<3.77	34	31	58	34	5.6	<3.77	<3.77	<3.77	163	1327	
9/6/10	115011	Room 7A	<4.12	<4.12	5.19	<4.12	<4.12	<4.12	<4.12	<4.12	<4.12	<4.12	5.19	1215	
11/24/10	120190	Room 7A	<5.34	<5.34	17.5	6.84	9.72	<5.34	<5.34	<5.34	<5.34	<5.34	34.1	936	
4/20/11	124177	Room 7A	<4.70	<4.70	14.8	<4.70	<4.70	<4.70	<4.70	<4.70	<4.70	<4.70	14.8	1065	
11/24/10	120191	Room 7B	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	941	
4/21/11	124188	Room 7B	<4.49	<4.49	17.6	12.9	18.3	8.33	<4.49	<4.49	<4.49	<4.49	57.3	1113	
11/24/10	120192	Room 7C													Not reported due
2/23/11	122818	Room 7C	<4.43	<4.43	10.6	<4.43	<4.43	<4.43	<4.43	<4.43	<4.43	<4.43	10.6	1128	
2/23/11	122819	Room 7C	<4.40	<4.40	14.8	<4.40	<4.40	<4.40	<4.40	<4.40	<4.40	<4.40	14.8	1137	
12/2/10	120206	Room B	<5.91	13.9	39.1	25.6	43.7	25.5	<5.91	<5.91	<5.91	<5.91	148	847	
5/21/11	122874	Room C	<4.23	<4.23	27.8	31.8	43.9	27.6	6.19	<4.23	<4.23	<4.23	137	1182	
12/2/10	120208	Room D	<5.81	<5.81	22.8	22.6	45.1	17.7	<5.81	<5.81	<5.81	<5.81	108	861	
12/2/10	120202	Sped Office	<5.49	11.3	37.6	26.8	42.2	16.3	<5.49	<5.49	<5.49	<5.49	134	912	
5/21/11	122873	Sped Office	<4.27	<4.27	29.4	27.6	46.6	21.7	<4.27	<4.27	<4.27	<4.27	125	1172	
9/6/10	115020	Teacher Work Roo	<5.05	6.76	52.5	26.1	25.4	18.7	8.58	<5.05	<5.05	<5.05	138	991	
11/24/10	120196	Teacher Work Room													Not reported due
11/24/10	120197	Teacher Work Roo	<5.36	<5.36	<5.36	14.8	18.9	<5.36	<5.36	<5.36	<5.36	<5.36	33.7	932	
11/24/10	120198	Teacher Work Roo	<5.26	<5.26	16.0	13.8	28.8	13.1	<5.26	<5.26	<5.26	<5.26	71.7	951	
4/21/11	124194	Teacher Work Roo	<4.54	<4.54	16.5	16.9	30.6	8.42	<4.54	<4.54	<4.54	<4.54	72.5	1101	
5/21/11	122872	Teacher Work Roo	<4.26	7.17	30.3	34.8	53.5	28.6	10.1	<4.26	<4.26	<4.26	164	1174	
11/20/10	120188	Teacher's Lounge	<4.35	7.48	19.9	19.7	27.3	14.6	<4.35	<4.35	<4.35	<4.35	88.7	1150	
5/21/11	122870	Teacher's Lounge	<4.24	9.41	23.8	29.2	33.6	16.8	4.63	<4.24	<4.24	<4.24	117	1180	
4/20/11	124186	Worker	<4.98	<4.98	<4.98	<4.98	<4.98	<4.98	<4.98	<4.98	<4.98	<4.98	<4.98	1003	

Sample Conditions
Following initial optimization of outdoor air delivery and central exhaust
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Following initial optimization of outdoor air delivery and central exhaust
Summer conditions
Following removal of exterior PCB caulk and the encapsulation of window glazing caulk
Following removal of exterior PCB caulk and the encapsulation of window glazing caulk
Following removal of exterior PCB caulk and the encapsulation of window glazing caulk
Following initial optimization of outdoor air delivery and central exhaust
lion due to the sample matrix
Following partial encapsulation of interior caulk located below the ceiling plenum, under optimization of outdoor air deliver and central exhaust
Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under summer outdoor air delivery (70 F set point, exhaust on at 8:00 AM), mini-wall, and full indoor caulk encapsulation.
Under summer outdoor air delivery (63 F set point, exhaust on at 6:00 AM), mini-wall, and full indoor caulk encapsulation.
Window opened
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Following removal of exterior PCB caulk and the encapsulation of window glazing caulk
Following initial optimization of outdoor air delivery and central exhaust
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Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under summer outdoor air delivery (70 F set point, exhaust on at 8:00 AM), mini-wall, and full indoor caulk encapsulation.
Under summer outdoor air delivery (63 F set point, exhaust on at 6:00 AM), mini-wall, and full indoor caulk encapsulation.
Window opened
Window opened
Following partial encapsulation of interior caulk located below the ceiling plenum, under optimization of outdoor air deliver and central exhaust
Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
Room separated into component parts with poly sheeting; results for investigation purposes only, not representative of exposure concentrations
Room separated into component parts with poly sheeting; results for investigation purposes only, not representative of exposure concentrations
Under winter ventilation, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
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Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Summer conditions
Following removal of exterior PCB caulk and the encapsulation of window glazing caulk
Following removal of exterior PCB caulk and the encapsulation of window glazing caulk

Following removal of exterior PCB caulk and the encapsulation of window glazing caulk
Following initial optimization of outdoor air delivery and central exhaust
Following partial encapsulation of interior caulk located below the ceiling plenum, under optimization of outdoor air deliver and central exhaust
Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
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Under winter ventilation, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
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Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under summer outdoor air delivery (70 F set point, exhaust on at 8:00 AM), mini-wall, and full indoor caulk encapsulation.
Under summer outdoor air delivery (63 F set point, exhaust on at 6:00 AM), mini-wall, and full indoor caulk encapsulation.
Window opened
Window opened
Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
Following removal of exterior PCB caulk and the encapsulation of window glazing caulk
Following initial optimization of outdoor air delivery and central exhaust
Following partial encapsulation of interior caulk located below the ceiling plenum, under optimization of outdoor air deliver and central exhaust
Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
Room separated into component parts with poly sheeting; results for investigation purposes only, not representative of exposure concentrations
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Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under summer outdoor air delivery (70 F set point, exhaust on at 8:00 AM), mini-wall, and full indoor caulk encapsulation.
Summer conditions
Following removal of exterior PCB caulk and the encapsulation of window glazing caulk
Following initial optimization of outdoor air delivery and central exhaust
tion due to the sample matrix
Following partial encapsulation of interior caulk located below the ceiling plenum, under optimization of outdoor air deliver and central exhaust
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under summer outdoor air delivery (70 F set point, exhaust on at 8:00 AM), mini-wall, and full indoor caulk encapsulation.
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Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.

Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
Room separated into component parts with poly sheeting; results for investigation purposes only, not representative of exposure concentrations
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Room separated into component parts with poly sheeting; results for investigation purposes only, not representative of exposure concentrations
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Window closed
Window closed
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Window closed, 2 medium filters
Window closed, 2 medium filters
Following partial encapsulation of interior caulk located below the ceiling plenum, under optimization of outdoor air deliver and central exhaust
Following initial optimization of outdoor air delivery and central exhaust
tion due to the sample matrix
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
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Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
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Under summer outdoor air delivery (63 F set point, exhaust on at 6:00 AM), mini-wall, and full indoor caulk encapsulation.
Window closed
Window closed
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
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Summer conditions
Following removal of exterior PCB caulk and the encapsulation of window glazing caulk
Following initial optimization of outdoor air delivery and central exhaust
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Window opened
Window opened
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
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Following partial encapsulation of interior caulk located below the ceiling plenum, under optimization of outdoor air deliver and central exhaust

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Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
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Room separated into component parts with poly sheeting; results for investigation purposes only, not representative of exposure concentrations
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Summer conditions
Following removal of exterior PCB caulk and the encapsulation of window glazing caulk
Following removal of exterior PCB caulk and the encapsulation of window glazing caulk
Following initial optimization of outdoor air delivery and central exhaust
Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Window closed
Window closed
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Window opened
Window opened
Following removal of exterior PCB caulk and the encapsulation of window glazing caulk
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under summer outdoor air delivery (70 F set point, exhaust on at 8:00 AM), mini-wall, and full indoor caulk encapsulation.
Window closed, 1 high filter
Window closed, 1 high filter
Summer conditions
Summer conditions
Following removal of exterior PCB caulk and the encapsulation of window glazing caulk
Following removal of exterior PCB caulk and the encapsulation of window glazing caulk
Following initial optimization of outdoor air delivery and central exhaust
Following initial optimization of outdoor air delivery and central exhaust
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Following partial encapsulation of interior caulk located below the ceiling plenum, under optimization of outdoor air deliver and central exhaust
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Under summer outdoor air delivery (63 F set point, exhaust on at 6:00 AM), mini-wall, and full indoor caulk encapsulation.
Window closed, 2 medium filters
Window closed, 2 medium filters
Window closed, 2 medium filters
Summer conditions
Following removal of exterior PCB caulk and the encapsulation of window glazing caulk

Following initial optimization of outdoor air delivery and central exhaust
tion due to the sample matrix
Following partial encapsulation of interior caulk located below the ceiling plenum, under optimization of outdoor air deliver and central exhaust
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Summer conditions
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Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
Room separated into component parts with poly sheeting; results for investigation purposes only, not representative of exposure concentrations
Under winter ventilation, mini-wall, and full indoor caulk encapsulation.
Under winter ventilation, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Window opened
Window opened
Following initial optimization of outdoor air delivery and central exhaust
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
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Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
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Under summer outdoor air delivery (70 F set point, exhaust on at 8:00 AM), mini-wall, and full indoor caulk encapsulation.
Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.

				Result (ppmw)									
Sample Da	Sample ID	Material	Description	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Aroclor 1262	Aroclor 1268	Total PCB
6/16/10	112207	Caulking	Exterior, grey	<5.0	<5.0	<5.0	<5.0	7.2	<5.0	<5.0	<5.0	<5.0	7.2
6/16/10	112208	Caulking	Exterior, grey	<3.9	<3.9	<3.9	<3.9	9.5	<3.9	<3.9	<3.9	<3.9	9.5
6/16/10	112209	Caulking	Exterior, white	<5,400	<5,400	<5,400	<5,400	15,000	<5,400	<5,400	<5,400	<5,400	15,000
6/16/10	112210	Caulking	Exterior, white	<8,700	<8,700	<8,700	<8,700	21,000	<8,700	<8,700	<8,700	<8,700	21,000
6/16/10	112211	Caulking	Exterior, white	<4,800	<4,800	<4,800	<4,800	16,000	<4,800	<4,800	<4,800	<4,800	16,000
6/16/10	112212	Caulking	Exterior, white	<5,900	<5,900	<5,900	<5,900	17,000	<5,900	<5,900	<5,900	<5,900	17,000
6/16/10	112213	Caulking	Exterior, white	<7,900	<7,900	<7,900	<7,900	9,900	<7,900	<7,900	<7,900	<7,900	9,900
6/17/10	112214	Caulking	Exterior, black	<0.50	<0.50	<0.50	<0.50	4.4	<0.50	<0.50	<0.50	<0.50	4.4
6/17/10	112215	Caulking	Exterior, clear	<3.8	<3.8	<3.8	<3.8	7.4	<3.8	<3.8	<3.8	<3.8	7.4
6/17/10	112216	Caulking	Exterior, grey	<0.24	<0.24	<0.24	<0.24	0.36	0.62	<0.24	<0.24	<0.24	0.98
6/17/10	112217	Caulking	Exterior, brown	<0.28	<0.28	<0.28	<0.28	0.88	<0.28	<0.28	<0.28	<0.28	0.88
6/17/10	112218	Caulking	Exterior, white	<25	<25	<25	<25	<25	190	<25	<25	<25	190
6/17/10	112219	Caulking	Exterior, white	<590	<590	<590	<590	<590	4,000	2,000	<590	<590	6,000
6/17/10	112220	Caulking	Exterior, grey	<1.9	<1.9	<1.9	<1.9	<1.9	6.8	<1.9	<1.9	<1.9	6.8
6/17/10	112221	Caulking	Exterior, grey	<0.47	<0.47	<0.47	<0.47	<0.47	2.9	<0.47	<0.47	<0.47	2.9
6/17/10	112222	Caulking	Exterior, grey	<0.46	<0.46	<0.46	<0.46	1.6	<0.46	<0.46	<0.46	<0.46	1.6
8/10/10	113725	Glazing	Room 6, exterior, gray window g	<0.85	<0.85	<0.85	<0.85	<0.85	0.89	<0.85	<0.85	<0.85	0.89
8/10/10	113726	Glazing	Room 6, exterior, white window	<0.32	<0.32	<0.32	<0.32	1.5	<0.32	<0.32	<0.32	<0.32	1.5
8/10/10	113727	Glazing	Room 6, exterior, white window	<1.3	<1.3	<1.3	<1.3	<1.3	2.6	<1.3	<1.3	<1.3	2.6
8/10/10	113728	Glazing	Room 6, interior, black window g	<26	<26	<26	<26	<26	150	<26	<26	<26	150
8/10/10	113729	Brick	Room 6, exterior, brick, end of w	<0.05	<0.05	<0.05	<0.05	0.53	<0.05	<0.05	<0.05	<0.05	0.53
8/10/10	113730	Brick	Room 6, exterior, brick, end of w	<0.05	<0.05	<0.05	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	0.08
8/10/10	113731	Brick	Location 4, exterior, brick, edge	<0.51	<0.51	<0.51	<0.51	4	<0.51	<0.51	<0.51	<0.51	4
8/10/10	113732	Brick	Location 4, exterior, brick, ½"	<0.09	<0.09	<0.09	<0.09	0.13	<0.09	<0.09	<0.09	<0.09	0.13
8/10/10	113733	Brick	Duplicate 112732	<0.07	<0.07	<0.07	<0.07	0.2	<0.07	<0.07	<0.07	<0.07	0.2
9/2/10	114976	Ceiling Tile	39C, old ceiling tile	<18	<18	<18	<18	<18	32	46	<18	<18	78
9/2/10	114977	Ceiling Tile	39C, shiny new yellow fiberglass	<2.9	<2.9	<2.9	<2.9	<2.9	5.1	3.8	<2.9	<2.9	8.9
9/2/10	114978	Ceiling Tile	39C, standard new ceiling tile	<2.8	<2.8	<2.8	<2.8	<2.8	4.5	<2.8	<2.8	<2.8	4.5
9/2/10	114979	Ceiling Tile	Duplicate 114976	<20	<20	<20	<20	<20	30	92	<20	<20	122
9/2/10	114980	Insulation	39C, fiberglass insulation	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3
9/2/10	114981	Ceiling Tile	36B, study center library, standa	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6
9/2/10	114982	Cove Base	36B, green cove with black mas	<49	<49	<49	<49	<49	140	<49	<49	<49	140
9/2/10	114985	Caulking	39B, interior caulk joint, adjacen	<180	<180	<180	<180	<180	630	120	<180	<180	750
9/2/10	114987	Ceiling Tile	Room 6, white tile, old face/coat	<480	<480	<480	<480	<480	530	<480	<480	<480	530
9/2/10	114988	Ceiling Tile	Room 6, white tile, shiny new fa	<24	<24	<24	<24	<24	76	65	<24	<24	141
9/2/10	114989	Ceiling Tile	Room 6, white tile, standard new	<4.3	<4.3	<4.3	<4.3	<4.3	7.3	11	<4.3	<4.3	18.3
9/2/10	114990	Ceiling Tile	Room 6, white tile, smooth new	<3.9	<3.9	<3.9	<3.9	<3.9	5.8	8.5	<3.9	<3.9	14.3
9/2/10	114991	Ceiling Tile	Duplicate 114987	<600	<600	<600	<600	<600	970	<600	<600	<600	970
9/2/10	114993	Insulation	Room 6, insulation paper with cl	<4.8	<4.8	<4.8	<4.8	<4.8	6.1	<4.8	<4.8	<4.8	6.1
9/2/10	114994	Caulking	Room 6, interior caulk joint	<2,500	<2,500	<2,500	<2,500	<2,500	9,400	20,000	<2,500	<2,500	29,400
9/2/10	114995	Cove Base	Room 6, green cove base with r	<58	<58	<58	<58	<58	170	<58	<58	<58	170
9/2/10	114996	Cove Base	Room 6, green cove base under	<31	<31	<31	<31	<31	160	<31	<31	<31	160
9/2/10	114997	Spaghetti Board	Room 6, spaghetti board, above	<6.8	<6.8	<6.8	<6.8	<6.8	15	<6.8	<6.8	<6.8	15
9/2/10	114998	Spaghetti Board	Duplicate 114997	<12	<12	<12	<12	<12	16	<12	<12	<12	16
9/2/10	114999	Mastic	Hallway, black mastic under tile	<2.7	<2.7	<2.7	<2.7	<2.7	13	<2.7	<2.7	<2.7	13
9/2/10	115000	Caulking	Hallway, interior caulk adjacent	<110	<110	<110	<110	<110	450	<110	<110	<110	450
9/2/10	115001	Tar Paper	Exterior, tar paper membrane, o	<1.3	<1.3	<1.3	<1.3	<1.3	2.8	<1.3	<1.3	<1.3	2.8
9/2/10	115002	Tar Paper	Duplicate 15001	<1.1	<1.1	<1.1	<1.1	<1.1	4.7	<1.1	<1.1	<1.1	4.7

9/2/10	115003	Tar Paper	Exterior tar paper membrane, ou	<970	<970	<970	<970	<970	300	<970	<970	<970	300
9/2/10	115004	Tar Paper	Room 39C, black adhesive in pl	<1.0	<1.0	<1.0	<1.0	<1.0	3.8	<1.0	<1.0	<1.0	3.8
9/7/10	115037	Tar Paper	Room 19, exterior corner, black	<0.53	<0.53	<0.53	3.9	<0.53	<0.53	<0.53	<0.53	<0.53	3.9
9/7/10	115038	Tar Paper	Duplicate 115037	<0.65	<0.65	<0.65	3.3	<0.65	<0.65	<0.65	<0.65	<0.65	3.3
9/7/10	115039	Tar Paper	Room 19, exterior corner, black	<0.33	<0.33	<0.33	<0.33	1.1	<0.33	<0.33	<0.33	<0.33	1.1
9/9/10	115075	Mastic	Room 6, black mastic	<81	<81	<81	<81	<81	280	<81	<81	<81	280
9/9/10	115076	Cove Base	Room 6, green cove base	<33	<33	<33	<33	<33	120	<33	<33	<33	120
9/9/10	115077	Caulking	Room 6, exterior caulk on green	<880	<880	<880	<880	<880	4,600	<880	5,100	<880	9,700
9/21/10	113832	Caulking	Room 24, interior caulk, window	<360	<360	<360	<360	<360	<360	3,200	<360	<360	3,200
9/21/10	113833	Caulking	Room 5, interior caulk, window s	<500	<500	<500	<500	<500	<500	2,100	<500	<500	2,100
9/22/10	113844	Insulation	Room 1, fiberglass insulation	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	4	<2.2	<2.2	4
9/22/10	113845	Insulation	Room 2, fiberglass insulation	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	3.5	<2.3	<2.3	3.5
9/22/10	113846	Insulation	Room 3, fiberglass insulation	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	16	<2.2	<2.2	16
9/22/10	113847	Insulation	Room 4, fiberglass insulation	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	21	<2.2	<2.2	21
9/22/10	113848	Insulation	Room 5, fiberglass insulation	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	8.8	<2.2	<2.2	8.8
9/22/10	113849	Insulation	Room 6, fiberglass insulation	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	4.1	<2.2	<2.2	4.1
9/22/10	113850	Insulation	Duplicate 113849	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	4.7	<2.3	<2.3	4.7
9/22/10	113851	Insulation	Hallway, fiberglass insulation	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	5.1	<2.3	<2.3	5.1
9/28/10	117624	Acoustical Panel	Room 5, acoustical panel	<1.1	<1.1	<1.1	<1.1	<1.1	2.7	2.6	<1.1	<1.1	5.3
9/28/10	117625	Acoustical Panel	Room 3, acoustical panel	<0.62	<0.62	<0.62	<0.62	<0.62	2.5	1.9	<0.62	<0.62	4.4
9/28/10	117626	Carpet	Room 5, carpet	<0.50	<0.50	<0.50	1.3	<0.50	1	<0.50	<0.50	<0.50	2.3
9/28/10	117627	Carpet	Room 3, carpet	<0.54	<0.54	<0.54	0.93	<0.54	1.2	<0.54	<0.54	<0.54	2.13
11/11/10	117671	Divider	Room 6, divider	<250	<250	<250	<250	<250	940	<250	<250	<250	940

Please Note: The purpose of this bulk sampling data was to characterize sources of PCB materials impacting the indoor air and was not intended to be a complete hazardous materials survey. It is recognized that additional characterization is needed prior to classifi

BULK

Sample Da	Sample ID	Material	Description	Result (ppmw)									
				Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Aroclor 1262	Aroclor 1268	Total PCB
6/16/10	112207	Caulking	Exterior, grey	<5.0	<5.0	<5.0	<5.0	7.2	<5.0	<5.0	<5.0	<5.0	7.2
6/16/10	112208	Caulking	Exterior, grey	<3.9	<3.9	<3.9	<3.9	9.5	<3.9	<3.9	<3.9	<3.9	9.5
6/16/10	112209	Caulking	Exterior, white	<5,400	<5,400	<5,400	<5,400	15,000	<5,400	<5,400	<5,400	<5,400	15,000
6/16/10	112210	Caulking	Exterior, white	<8,700	<8,700	<8,700	<8,700	21,000	<8,700	<8,700	<8,700	<8,700	21,000
6/16/10	112211	Caulking	Exterior, white	<4,800	<4,800	<4,800	<4,800	16,000	<4,800	<4,800	<4,800	<4,800	16,000
6/16/10	112212	Caulking	Exterior, white	<5,900	<5,900	<5,900	<5,900	17,000	<5,900	<5,900	<5,900	<5,900	17,000
6/16/10	112213	Caulking	Exterior, white	<7,900	<7,900	<7,900	<7,900	9,900	<7,900	<7,900	<7,900	<7,900	9,900
6/17/10	112214	Caulking	Exterior, black	<0.50	<0.50	<0.50	<0.50	4.4	<0.50	<0.50	<0.50	<0.50	4.4
6/17/10	112215	Caulking	Exterior, clear	<3.8	<3.8	<3.8	<3.8	7.4	<3.8	<3.8	<3.8	<3.8	7.4
6/17/10	112216	Caulking	Exterior, grey	<0.24	<0.24	<0.24	<0.24	0.36	0.62	<0.24	<0.24	<0.24	0.98
6/17/10	112217	Caulking	Exterior, brown	<0.28	<0.28	<0.28	<0.28	0.88	<0.28	<0.28	<0.28	<0.28	0.88
6/17/10	112218	Caulking	Exterior, white	<25	<25	<25	<25	<25	190	<25	<25	<25	190
6/17/10	112219	Caulking	Exterior, white	<590	<590	<590	<590	<590	4,000	2,000	<590	<590	6,000
6/17/10	112220	Caulking	Exterior, grey	<1.9	<1.9	<1.9	<1.9	<1.9	6.8	<1.9	<1.9	<1.9	6.8
6/17/10	112221	Caulking	Exterior, grey	<0.47	<0.47	<0.47	<0.47	<0.47	2.9	<0.47	<0.47	<0.47	2.9
6/17/10	112222	Caulking	Exterior, grey	<0.46	<0.46	<0.46	<0.46	1.6	<0.46	<0.46	<0.46	<0.46	1.6
8/10/10	113725	Glazing	Room 6, exterior, gray window g	<0.85	<0.85	<0.85	<0.85	<0.85	0.89	<0.85	<0.85	<0.85	0.89
8/10/10	113726	Glazing	Room 6, exterior, white window (	<0.32	<0.32	<0.32	<0.32	1.5	<0.32	<0.32	<0.32	<0.32	1.5
8/10/10	113727	Glazing	Room 6, exterior, white window (	<1.3	<1.3	<1.3	<1.3	<1.3	2.6	<1.3	<1.3	<1.3	2.6
8/10/10	113728	Glazing	Room 6, interior, black window g	<26	<26	<26	<26	<26	150	<26	<26	<26	150
8/10/10	113729	Brick	Room 6, exterior, brick, end of w	<0.05	<0.05	<0.05	<0.05	0.53	<0.05	<0.05	<0.05	<0.05	0.53
8/10/10	113730	Brick	Room 6, exterior, brick, end of w	<0.05	<0.05	<0.05	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	0.08
8/10/10	113731	Brick	Location 4, exterior, brick, edge	<0.51	<0.51	<0.51	<0.51	4	<0.51	<0.51	<0.51	<0.51	4
8/10/10	113732	Brick	Location 4, exterior, brick, ½"	<0.09	<0.09	<0.09	<0.09	0.13	<0.09	<0.09	<0.09	<0.09	0.13
8/10/10	113733	Brick	Duplicate 112732	<0.07	<0.07	<0.07	<0.07	0.2	<0.07	<0.07	<0.07	<0.07	0.2
9/2/10	114976	Ceiling Tile	39C, old ceiling tile	<18	<18	<18	<18	<18	32	46	<18	<18	78
9/2/10	114977	Ceiling Tile	39C, shiny new yellow fiberglass	<2.9	<2.9	<2.9	<2.9	<2.9	5.1	3.8	<2.9	<2.9	8.9
9/2/10	114978	Ceiling Tile	39C, standard new ceiling tile	<2.8	<2.8	<2.8	<2.8	<2.8	4.5	<2.8	<2.8	<2.8	4.5
9/2/10	114979	Ceiling Tile	Duplicate 114976	<20	<20	<20	<20	<20	30	92	<20	<20	122
9/2/10	114980	Insulation	39C, fiberglass insulation	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3
9/2/10	114981	Ceiling Tile	36B, study center library, standa	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6
9/2/10	114982	Cove Base	36B, green cove with black mast	<49	<49	<49	<49	<49	140	<49	<49	<49	140
9/2/10	114985	Caulking	39B, interior caulk joint, adjacent	<180	<180	<180	<180	<180	630	120	<180	<180	750
9/2/10	114987	Ceiling Tile	Room 6, white tile, old face/coat	<480	<480	<480	<480	<480	530	<480	<480	<480	530
9/2/10	114988	Ceiling Tile	Room 6, white tile, shiny new fac	<24	<24	<24	<24	<24	76	65	<24	<24	141
9/2/10	114989	Ceiling Tile	Room 6, white tile, standard new	<4.3	<4.3	<4.3	<4.3	<4.3	7.3	11	<4.3	<4.3	18.3
9/2/10	114990	Ceiling Tile	Room 6, white tile, smooth new t	<3.9	<3.9	<3.9	<3.9	<3.9	5.8	8.5	<3.9	<3.9	14.3
9/2/10	114991	Ceiling Tile	Duplicate 114987	<600	<600	<600	<600	<600	970	<600	<600	<600	970
9/2/10	114993	Insulation	Room 6, insulation paper with cl	<4.8	<4.8	<4.8	<4.8	<4.8	6.1	<4.8	<4.8	<4.8	6.1
9/2/10	114994	Caulking	Room 6, interior caulk joint	<2,500	<2,500	<2,500	<2,500	<2,500	9,400	20,000	<2,500	<2,500	29,400
9/2/10	114995	Cove Base	Room 6, green cove base with m	<58	<58	<58	<58	<58	170	<58	<58	<58	170

9/2/10	114996	Cove Base	Room 6, green cove base under	<31	<31	<31	<31	<31	160	<31	<31	<31	160
9/2/10	114997	Spaghetti Board	Room 6, spaghetti board, above	<6.8	<6.8	<6.8	<6.8	<6.8	15	<6.8	<6.8	<6.8	15
9/2/10	114998	Spaghetti Board	Duplicate 114997	<12	<12	<12	<12	<12	16	<12	<12	<12	16
9/2/10	114999	Mastic	Hallway, black mastic under tile	<2.7	<2.7	<2.7	<2.7	<2.7	13	<2.7	<2.7	<2.7	13
9/2/10	115000	Caulking	Hallway, interior caulk adjacent t	<110	<110	<110	<110	<110	450	<110	<110	<110	450
9/2/10	115001	Tar Paper	Exterior, tar paper membrane, o	<1.3	<1.3	<1.3	<1.3	<1.3	2.8	<1.3	<1.3	<1.3	2.8
9/2/10	115002	Tar Paper	Duplicate 15001	<1.1	<1.1	<1.1	<1.1	<1.1	4.7	<1.1	<1.1	<1.1	4.7
9/2/10	115003	Tar Paper	Exterior tar paper membrane, ou	<970	<970	<970	<970	<970	300	<970	<970	<970	300
9/2/10	115004	Tar Paper	Room 39C, black adhesive in pl	<1.0	<1.0	<1.0	<1.0	<1.0	3.8	<1.0	<1.0	<1.0	3.8
9/7/10	115037	Tar Paper	Room 19, exterior corner, black	<0.53	<0.53	<0.53	3.9	<0.53	<0.53	<0.53	<0.53	<0.53	3.9
9/7/10	115038	Tar Paper	Duplicate 115037	<0.65	<0.65	<0.65	3.3	<0.65	<0.65	<0.65	<0.65	<0.65	3.3
9/7/10	115039	Tar Paper	Room 19, exterior corner, black	<0.33	<0.33	<0.33	<0.33	1.1	<0.33	<0.33	<0.33	<0.33	1.1
9/9/10	115075	Mastic	Room 6, black mastic	<81	<81	<81	<81	<81	280	<81	<81	<81	280
9/9/10	115076	Cove Base	Room 6, green cove base	<33	<33	<33	<33	<33	120	<33	<33	<33	120
9/9/10	115077	Caulking	Room 6, exterior caulk on green	<880	<880	<880	<880	<880	4,600	<880	5,100	<880	9,700
9/21/10	113832	Caulking	Room 24, interior caulk, window	<360	<360	<360	<360	<360	<360	3,200	<360	<360	3,200
9/21/10	113833	Caulking	Room 5, interior caulk, window s	<500	<500	<500	<500	<500	<500	2,100	<500	<500	2,100
9/22/10	113844	Insulation	Room 1, fiberglass insulation	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	4	<2.2	<2.2	4
9/22/10	113845	Insulation	Room 2, fiberglass insulation	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	3.5	<2.3	<2.3	3.5
9/22/10	113846	Insulation	Room 3, fiberglass insulation	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	16	<2.2	<2.2	16
9/22/10	113847	Insulation	Room 4, fiberglass insulation	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	21	<2.2	<2.2	21
9/22/10	113848	Insulation	Room 5, fiberglass insulation	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	8.8	<2.2	<2.2	8.8
9/22/10	113849	Insulation	Room 6, fiberglass insulation	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	4.1	<2.2	<2.2	4.1
9/22/10	113850	Insulation	Duplicate 113849	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	4.7	<2.3	<2.3	4.7
9/22/10	113851	Insulation	Hallway, fiberglass insulation	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	5.1	<2.3	<2.3	5.1
9/28/10	117624	Acoustical Panel	Room 5, acoustical panel	<1.1	<1.1	<1.1	<1.1	<1.1	2.7	2.6	<1.1	<1.1	5.3
9/28/10	117625	Acoustical Panel	Room 3, acoustical panel	<0.62	<0.62	<0.62	<0.62	<0.62	2.5	1.9	<0.62	<0.62	4.4
9/28/10	117626	Carpet	Room 5, carpet	<0.50	<0.50	<0.50	1.3	<0.50	1	<0.50	<0.50	<0.50	2.3
9/28/10	117627	Carpet	Room 3, carpet	<0.54	<0.54	<0.54	0.93	<0.54	1.2	<0.54	<0.54	<0.54	2.13
11/11/10	117671	Divider	Room 6, divider	<250	<250	<250	<250	<250	940	<250	<250	<250	940

Please Note: The purpose of this bulk sampling data was to characterize sources of PCB materials impacting the indoor air and was not intended to be a complete hazardous materials survey. It is recognized that additional characterization is

Bulk

; needed prior to classification and disposal of some of these materials.

Bunnel
AIR

Sample Da	Sample ID	Location	Result (ng/m3)										
			Monochlorol	Dichlorobipl	Trichlorobip	Tetrachlorob	Pentachlorol	Hexachlorob	Heptachlorol	Octachlorob	Nonachlorob	Decachlorob	Total Homol
7/22/10	95349	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
7/22/10	95350	Room 1A	<3.75	7.51	62.5	55.3	67.0	83.3	23.6	<3.75	<3.75	<3.75	299
7/22/10	105529	Room 6	<3.80	37.7	298	282	183	426	465	105	4.94	<3.80	2E3
7/22/10	105530	Room 39C	<3.79	7.65	115	89.4	41.2	60.3	27.8	<3.79	<3.79	<3.79	342
7/22/10	105531	Room 39C	<3.85	6.93	107	81.7	36.3	41.3	11.0	<3.85	<3.85	<3.85	284
7/22/10	105532	Room 31A	<3.79	36.3	185	124	75.0	102	39.3	<3.79	<3.79	<3.79	562
7/22/10	105533	Room 13	<3.81	9.89	128	94.4	39.0	37.7	9.82	<3.81	<3.81	<3.81	319
7/22/10	105534	Room 24	<3.74	59.4	332	119	62.6	77.9	29.9	<3.74	<3.74	<3.74	680
7/22/10	105535	Room 5	<3.80	15.6	119	98.7	67.2	109	48.5	<3.80	<3.80	<3.80	459
7/22/10	105536	Outdoors	<3.79	<3.79	<3.79	<3.79	<3.79	<3.79	<3.79	<3.79	<3.79	<3.79	<3.79
8/25/10	114496	Room 39C	<3.09	16.5	147	119	130	66.7	15.4	<3.09	<3.09	<3.09	495
8/25/10	114497	Room 39C	<3.09	21.3	127	121	107	50.2	12.0	<3.09	<3.09	<3.09	438
8/25/10	114498	Room 39B	<3.10	19.3	144	121	85.3	39.9	8.91	<3.10	<3.10	<3.10	419
8/25/10	114499	Outdoors											
8/25/10	114500	Field Blank	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00
8/26/10	114344	Room 6	<3.88	56.6	284	191	133	80.6	19.1	<3.88	<3.88	<3.88	764
8/26/10	114345	Room 6	<3.89	58.0	312	206	147	77.5	17.7	<3.89	<3.89	<3.89	816
8/26/10	114346	Room 5	<3.94	60.8	239	179	148	86.7	22.9	<3.94	<3.94	<3.94	736
8/26/10	114347	Room 2	<3.94	72.3	262	167	157	96.1	21.0	<3.94	<3.94	<3.94	775
8/26/10	114348	Room 1	<3.89	26.3	82.4	103	110	77.6	26.9	<3.89	<3.89	<3.89	426
8/26/10	114349	Outdoors	<3.87	<3.87	<3.87	<3.87	<3.87	<3.87	<3.87	<3.87	<3.87	<3.87	<3.87
8/26/10	114350	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
8/27/10	114361	Room 31A	<5.05	72.5	168	125	99.4	79.4	30.7	<5.05	<5.05	<5.05	575
8/27/10	114362	Room 31A	<5.05	64.5	164	116	99.8	89.2	31.4	<5.05	<5.05	<5.05	565
8/27/10	114363	Room 13	<3.93	22.2	113	111	60.3	33.5	<3.93	<3.93	<3.93	<3.93	340
8/27/10	114364	Room 24	<3.90	72.7	242	119	82.0	67.7	18.0	<3.90	<3.90	<3.90	601
8/27/10	114365	Library	<3.79	38.1	151	120	100	40.4	20.1	<3.79	<3.79	<3.79	469
8/27/10	114366	Outdoors	<3.92	<3.92	<3.92	<3.92	<3.92	<3.92	<3.92	<3.92	<3.92	<3.92	<3.92
8/27/10	114367	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
9/6/10	115006	Outdoors	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20
9/6/10	115007	Room 1	<4.38	7.70	23.6	21.6	27.5	28.2	9.89	<4.38	<4.38	<4.38	118
9/6/10	115008	Room 2	<4.17	35.3	138	92.5	72.4	94.2	22.1	<4.17	<4.17	<4.17	455
9/6/10	115009	Room 5	<4.35	17.4	114	81.0	49.3	45.1	13.0	<4.35	<4.35	<4.35	320
9/6/10	115010	Room 6	<4.30	30.8	143	119	89.5	76.9	23.8	<4.30	<4.30	<4.30	483
9/6/10	115011	Room 7A	<4.12	<4.12	5.19	<4.12	<4.12	<4.12	<4.12	<4.12	<4.12	<4.12	5.19

9/6/10	115012	Art	<4.20	16.3	46.2	42.0	39.7	40.3	9.33	<4.20	<4.20	<4.20	194
9/6/10	115013	Room 13	<5.11	17.1	48.6	50.7	25.6	32.7	9.30	<5.11	<5.11	<5.11	184
9/6/10	115014	Room 21A	<4.32	33.4	145	118	62.8	39.6	10.7	<4.32	<4.32	<4.32	410
9/6/10	115015	Room 24	<4.31	26.9	80.4	38.2	31.3	39.3	10.0	<4.31	<4.31	<4.31	226
9/6/10	115016	Room 31A	11.5	30.9	93.3	83.0	80.2	68.9	27.5	23.5	25.7	<4.24	444
9/6/10	115017	Room 39C	<4.27	14.9	71.8	72.1	38.8	34.1	13.1	<4.27	<4.27	<4.27	245
9/6/10	115018	Library	<4.32	15.1	64.7	58.7	29.5	18.7	9.41	<4.32	<4.32	<4.32	196
9/6/10	115019	Library	<5.34	16.0	61.9	54.0	29.8	24.7	11.1	<5.34	<5.34	<5.34	198
9/6/10	115020	Teacher Work Roor	<5.05	6.76	52.5	26.1	25.4	18.7	8.58	<5.05	<5.05	<5.05	138
9/6/10	115021	Basement	<5.50	20.3	66.1	51.0	57.9	31.1	<5.50	<5.50	<5.50	<5.50	227
9/6/10	115022	Room 39C	<5.35	23.4	156	133	150	86.0	13.8	<5.35	<5.35	<5.35	562
9/6/10	115023	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
9/12/10	115136	Room 2	<40.6	<40.6	52.0	<40.6	<40.6	<40.6	106	<40.6	<40.6	<40.6	158
9/12/10	115137	Room 5	<40.1	<40.1	<40.1	<40.1	<40.1	<40.1	<40.1	<40.1	<40.1	<40.1	<40.1
9/12/10	115138	Room 21A	<39.5	<39.5	<39.5	<39.5	<39.5	<39.5	<39.5	<39.5	<39.5	<39.5	<39.5
9/12/10	115139	Room 39C	<40.6	<40.6	<40.6	<40.6	<40.6	<40.6	<40.6	<40.6	<40.6	<40.6	<40.6
9/12/10	115140	Room 13	<40.7	<40.7	<40.7	<40.7	<40.7	<40.7	<40.7	<40.7	<40.7	<40.7	<40.7
9/12/10	115141	Room 24	<40.7	<40.7	41.5	<40.7	<40.7	<40.7	<40.7	<40.7	<40.7	<40.7	41.5
9/12/10	115142	Room 26	<41.1	<41.1	<41.1	<41.1	<41.1	<41.1	<41.1	<41.1	<41.1	<41.1	<41.1
9/12/10	115143	Field Blank	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
9/19/10	117216	Room 1	<4.40	<4.40	8.88	13.3	14.3	18.6	8.36	<4.40	<4.40	<4.40	63.4
9/19/10	117217	Room 39C	<4.27	5.12	24.3	24.7	21.4	17.2	7.09	<4.27	<4.27	<4.27	99.9
9/19/10	117218	Room 24	<4.15	14.9	59.8	36.2	26.6	25.7	9.96	<4.15	<4.15	<4.15	173
9/19/10	117219	Room 2	<5.21	15.4	52.7	42.9	35.5	31.3	11.7	<5.21	<5.21	<5.21	189
9/19/10	117220	Room 21	<4.22	19.0	57.7	47.5	30.1	26.5	11.3	<4.22	<4.22	<4.22	193
9/19/10	117221	Room 6	<4.29	13.8	54.3	38.2	30.3	23.7	10.2	<4.29	<4.29	<4.29	171
9/19/10	117222	Outdoors	<4.46	<4.46	<4.46	<4.46	<4.46	<4.46	<4.46	<4.46	<4.46	<4.46	<4.46
9/19/10	117223	Room 5	<4.35	14.7	54.9	55.0	31.8	28.5	10.9	<4.35	<4.35	<4.35	196
9/19/10	117224	Room 26	<4.19	6.29	25.5	25.2	10.1	11.7	<4.19	<4.19	<4.19	<4.19	78.8
9/19/10	117225	Room 13	<4.17	14.3	43.4	43.3	25.4	23.0	5.59	<4.17	<4.17	<4.17	155
9/19/10	117226	Media Blank	<5.00	11.0	35.9	34.6	19.0	19.2	8.60	<5.00	<5.00	<5.00	128
9/19/10	117227	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
9/19/10	117228	Room 6	<4.19	11.5	41.3	32.9	28.5	30.7	8.05	<4.19	<4.19	<4.19	153
9/27/10	117257	Outdoors	<4.32	<4.32	<4.32	<4.32	<4.32	<4.32	<4.32	<4.32	<4.32	<4.32	<4.32
9/27/10	117258	Room 6	<4.48	13.9	66.1	47.2	55.9	24.1	5.64	<4.48	<4.48	<4.48	213
9/27/10	117259	Room 5	<4.36	10.3	46.0	39.7	35.6	18.0	<4.36	<4.36	<4.36	<4.36	149
9/27/10	117260	Room 2	<4.52	7.23	54.1	29.3	53.9	16.5	5.51	<4.52	<4.52	<4.52	166

9/27/10	117261	Room 2	<4.49	12.8	38.2	33.7	40.0	24.7	<4.49	<4.49	<4.49	<4.49	150
9/27/10	117262	Room 1	<4.51	<4.51	13.3	16.1	32.0	14.7	<4.51	<4.51	<4.51	<4.51	76.1
9/27/10	117263	Room 6	<5.00	10.9	108	120	190	79.0	18.4	<5.00	<5.00	<5.00	526
9/27/10	117264	Room 5	<6.20	<6.20	30.2	61.5	172	188	96.4	21.1	<6.20	<6.20	570
9/27/10	117265	Room 2	<5.04	<5.04	26.3	44.8	87.4	76.7	38.8	13.6	<5.04	<5.04	287
9/27/10	117266	Room 1	<4.98	<4.98	15.7	29.3	87.1	102	31.2	<4.98	<4.98	<4.98	265
9/27/10	117267	Media Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
9/27/10	117268	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
9/28/10	117269	Room 31A	<4.27	15.5	65.0	53.2	76.5	55.0	16.5	<4.27	<4.27	<4.27	282
9/28/10	117270	Psychologist Office	<4.12	21.6	73.3	55.8	64.7	29.6	7.98	<4.12	<4.12	<4.12	253
9/28/10	117271	Room 31A											
9/28/10	117272	Psychologist Office											
9/29/10	117273	Room 6	<4.42	24.5	110	91.0	92.7	51.2	14.5	<4.42	<4.42	<4.42	383
9/29/10	117274	Room 6	<4.40	20.6	95.1	78.6	75.3	51.3	14.0	<4.40	<4.40	<4.40	335
9/29/10	117275	Room 5	<4.36	18.9	62.2	48.0	49.8	30.0	<4.36	<4.36	<4.36	<4.36	209
9/29/10	117276	Room 5											
9/29/10	117277	Room 4	<4.37	29.3	87.3	59.8	95.3	61.5	10.9	<4.37	<4.37	<4.37	344
9/29/10	117278	Room 3	<4.38	25.6	63.2	75.4	118	64.6	16.9	<4.38	<4.38	<4.38	364
9/29/10	117279	Room 2	<4.41	23.8	76.8	49.3	60.5	36.7	6.26	<4.41	<4.41	<4.41	253
9/29/10	117280	Room 1	<4.42	<4.42	25.5	30.9	44.6	37.6	14.3	<4.42	<4.42	<4.42	153
9/29/10	117281	Outdoors	<4.44	<4.44	<4.44	<4.44	<4.44	<4.44	<4.44	<4.44	<4.44	<4.44	<4.44
9/29/10	117282	Media Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
9/29/10	117283	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
10/18/10	109987	Outdoors	<4.28	<4.28	91.6	140	97.6	42.3	15.9	<4.28	<4.28	<4.28	387
10/18/10	109988	Room 6	<4.32	14.0	60.4	40.2	49.0	18.8	<4.32	<4.32	<4.32	<4.32	182
10/18/10	109989	Room 1	<4.33	8.08	44.8	35.8	42.1	13.7	<4.33	<4.33	<4.33	<4.33	145
10/18/10	109990	Room 1	<4.30	<4.30	20.6	26.3	37.8	22.6	<4.30	<4.30	<4.30	<4.30	108
10/18/10	109991	Room 1	<4.23	<4.23	15.8	19.1	33.5	13.3	<4.23	<4.23	<4.23	<4.23	81.8
10/18/10	109992	Room 2	<4.47	<4.47	18.9	11.8	22.3	<4.47	<4.47	<4.47	<4.47	<4.47	53.0
10/18/10	109993	Room 2	<4.47	<4.47	19.2	12.9	19.5	<4.47	<4.47	<4.47	<4.47	<4.47	51.6
10/18/10	109994	Room 2	<4.72	19.5	62.1	63.3	58.8	41.6	28.2	<4.72	<4.72	<4.72	274
10/18/10	109995	Room 2	<4.62	15.4	36.3	17.0	16.1	11.9	<4.62	<4.62	<4.62	<4.62	97.0
10/18/10	109996	Room 2	<4.52	<4.52	14.2	8.15	<4.52	<4.52	<4.52	<4.52	<4.52	<4.52	22.3
10/18/10	109997	Media Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
10/19/10	109998	Room 3	<4.42	14.1	25.0	25.7	35.9	9.28	<4.42	<4.42	<4.42	<4.42	111
10/19/10	109999	Room 3	<4.50	<4.50	14.9	19.2	24.4	8.99	<4.50	<4.50	<4.50	<4.50	67.4
10/19/10	110000	Room 3	<4.38	<4.38	16.1	19.5	18.0	<4.38	<4.38	<4.38	<4.38	<4.38	53.7

10/19/10	110001	Room 4	<4.36	13.7	29.4	22.2	41.8	18.2	<4.36	<4.36	<4.36	<4.36	126
10/19/10	110002	Room 4	<4.58	24.2	45.2	22.1	21.8	4.67	<4.58	<4.58	<4.58	<4.58	118
10/19/10	110003	Room 5	<4.50	<4.50	19.2	15.9	24.7	7.19	<4.50	<4.50	<4.50	<4.50	67.0
10/19/10	110004	Room 5	<4.40	<4.40	20.7	18.5	18.3	7.30	<4.40	<4.40	<4.40	<4.40	64.7
10/19/10	110005	Room 5	<4.57	<4.57	25.0	26.3	28.9	9.78	<4.57	<4.57	<4.57	<4.57	90.0
10/19/10	110006	Outdoors	<5.54	<5.54	<5.54	<5.54	<5.54	<5.54	<5.54	<5.54	<5.54	<5.54	<5.54
10/19/10	110007	Media Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	6.80	6.80
11/4/10	110008	Room 6	<4.30	7.56	28.4	35.0	41.7	25.0	5.93	<4.30	<4.30	<4.30	144
11/4/10	110009	Room 6	<4.23	<4.23	26.9	27.3	43.8	15.2	4.77	<4.23	<4.23	<4.23	118
11/4/10	110010	Room 4	<4.20	<4.20	30.7	21.1	32.5	15.0	<4.20	<4.20	5.43	<4.20	105
11/4/10	110011	Outdoors	<4.58	<4.58	<4.58	<4.58	<4.58	<4.58	<4.58	<4.58	<4.58	<4.58	<4.58
11/4/10	110012	Media Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
11/11/10	117655	Room 1	<4.43	<4.43	22.5	26.2	39.6	22.6	5.31	<4.43	<4.43	<4.43	116
11/11/10	117656	Room 2	<4.24	<4.24	13.6	12.3	22.6	11.6	<4.24	<4.24	<4.24	<4.24	60.1
11/11/10	117657	Room 3	<4.40	<4.40	22.2	23.2	38.8	25.4	<4.40	<4.40	<4.40	<4.40	110
11/11/10	117658	Room 5	<4.45	<4.45	26.9	36.9	43.1	21.0	<4.45	<4.45	<4.45	<4.45	128
11/11/10	117659	Room 11	<4.53	<4.53	13.2	16.8	24.9	10.1	<4.53	<4.53	<4.53	<4.53	65.0
11/11/10	117660	Room 13	<4.54	<4.54	21.2	23.4	29.4	14.7	<4.54	<4.54	<4.54	<4.54	88.8
11/11/10	117661	Room 13	<4.50	<4.50	19.3	24.1	34.8	15.7	<4.50	<4.50	<4.50	<4.50	93.7
11/11/10	117662	Room 19	<4.45	<4.45	<4.45	<4.45	11.6	<4.45	<4.45	<4.45	<4.45	<4.45	11.6
11/11/10	117663	Outdoors	<4.61	<4.61	<4.61	<4.61	<4.61	<4.61	<4.61	<4.61	<4.61	<4.61	<4.61
11/11/10	117664	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
11/20/10	120176	Outdoors	<4.08	<4.08	<4.08	<4.08	<4.08	<4.08	<4.08	<4.08	<4.08	<4.08	<4.08
11/20/10	120177	Room 20	<4.17	<4.17	13.6	11.4	24.2	7.93	<4.17	<4.17	<4.17	<4.17	57.1
11/20/10	120178	Room 21B	<4.29	<4.29	42.8	55.2	53.9	26.9	8.66	<4.29	<4.29	<4.29	188
11/20/10	120179	Room 22	<4.35	<4.35	10.8	7.48	6.35	<4.35	<4.35	<4.35	<4.35	<4.35	24.6
11/20/10	120180	Room 23	<4.21	<4.21	25.7	37.0	42.3	30.1	7.59	<4.21	<4.21	<4.21	142
11/20/10	120181	Room 24	<4.33	6.49	30.2	22.8	29.0	18.4	<4.33	<4.33	<4.33	<4.33	107
11/20/10	120182	Room 24	<4.37	8.21	26.6	20.3	31.3	17.9	<4.37	<4.37	<4.37	<4.37	105
11/20/10	120183	Room 25	<4.36	7.24	28.7	26.3	39.3	23.7	5.15	<4.36	<4.36	<4.36	130
11/20/10	120184	Room 31A	<4.34	<4.34	16.4	20.7	30.7	21.1	4.51	<4.34	<4.34	<4.34	93.7
11/20/10	120185	Room 31B	<4.37	8.22	31.9	33.2	36.7	20.1	4.55	<4.37	<4.37	<4.37	135
11/20/10	120186	Room 39B	<4.28	<4.28	15.6	16.1	19.6	12.3	<4.28	<4.28	<4.28	<4.28	63.6
11/20/10	120187	Room 39C	<4.42	<4.42	26.0	34.9	40.2	23.8	<4.42	<4.42	<4.42	<4.42	125
11/20/10	120188	Teacher's Lounge	<4.35	7.48	19.9	19.7	27.3	14.6	<4.35	<4.35	<4.35	<4.35	88.7
11/20/10	120189	Media Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
11/24/10	120190	Room 7A	<5.34	<5.34	17.5	6.84	9.72	<5.34	<5.34	<5.34	<5.34	<5.34	34.1

11/24/10	120191	Room 7B	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31
11/24/10	120192	Room 7C											
11/24/10	120193	Room 26	<5.22	<5.22	12.2	10.7	16.2	7.52	<5.22	<5.22	<5.22	<5.22	46.6
11/24/10	120194	Room 27	<5.23	<5.23	19.0	12.6	28.9	8.58	<5.23	<5.23	<5.23	<5.23	69.0
11/24/10	120195	Library	<5.35	<5.35	28.0	35.4	41.6	19.2	10.4	<5.35	<5.35	<5.35	135
11/24/10	120196	Teacher Work Room											
11/24/10	120197	Teacher Work Roor	<5.36	<5.36	<5.36	14.8	18.9	<5.36	<5.36	<5.36	<5.36	<5.36	33.7
11/24/10	120198	Teacher Work Roor	<5.26	<5.26	16.0	13.8	28.8	13.1	<5.26	<5.26	<5.26	<5.26	71.7
11/24/10	120199	Outdoors	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95
11/24/10	120200	Media Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
12/2/10	120201	Gym	<5.40	<5.40	13.2	14.4	10.1	<5.40	<5.40	<5.40	<5.40	<5.40	37.7
12/2/10	120202	Sped Office	<5.49	11.3	37.6	26.8	42.2	16.3	<5.49	<5.49	<5.49	<5.49	134
12/2/10	120203	Room 21A	<5.46	20.1	28.0	25.6	20.7	14.8	<5.46	<5.46	<5.46	<5.46	109
12/2/10	120204	Room 21A	29.8	74.3	131	285	264	271	162	115	80.8	14.8	1E3
12/2/10	120205	Art	<5.54	<5.54	14.6	15.3	<5.54	<5.54	<5.54	<5.54	<5.54	<5.54	29.9
12/2/10	120206	Room B	<5.91	13.9	39.1	25.6	43.7	25.5	<5.91	<5.91	<5.91	<5.91	148
12/2/10	120207	Kitchen	<5.81	<5.81	34.1	32.3	<5.81	<5.81	<5.81	<5.81	<5.81	<5.81	66.4
12/2/10	120208	Room D	<5.81	<5.81	22.8	22.6	45.1	17.7	<5.81	<5.81	<5.81	<5.81	108
12/2/10	120209	Office - Art	<5.98	18.3	43.4	32.3	29.8	<5.98	<5.98	<5.98	<5.98	<5.98	124
12/2/10	120210	Office - Sandborne	<6.00	<6.00	23.3	29.5	13.0	<6.00	<6.00	<6.00	<6.00	<6.00	65.8
12/2/10	120211	Outdoors	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95	<5.95
12/2/10	120212	Media Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
2/23/11	122816	Room 1	<4.37	<4.37	26.4	32.5	46.5	32.0	8.47	<4.37	<4.37	<4.37	146
2/23/11	122817	Room 6	<4.39	<4.39	16.7	16.0	37.8	22.3	4.84	<4.39	<4.39	<4.39	97.4
2/23/11	122818	Room 7C	<4.43	<4.43	10.6	<4.43	<4.43	<4.43	<4.43	<4.43	<4.43	<4.43	10.6
2/23/11	122819	Room 7C	<4.40	<4.40	14.8	<4.40	<4.40	<4.40	<4.40	<4.40	<4.40	<4.40	14.8
2/23/11	122820	Room 13	<4.09	4.91	14.3	17.1	38.8	19.0	<4.09	<4.09	<4.09	<4.09	94.0
2/23/11	122821	Room 21A	<4.40	8.14	31.1	23.4	27.7	12.8	<4.40	<4.40	<4.40	<4.40	103
2/23/11	122822	Room 24	<4.39	7.00	21.5	15.9	27.6	13.7	<4.39	<4.39	<4.39	<4.39	85.7
2/23/11	122823	Room 39C	<4.42	<4.42	12.7	21.6	27.1	14.3	<4.42	<4.42	<4.42	<4.42	75.8
2/23/11	122824	Outdoors	<4.37	<4.37	<4.37	<4.37	<4.37	<4.37	<4.37	<4.37	<4.37	<4.37	<4.37
2/23/11	122825	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
4/20/11	124176	Room 2	<4.70	<4.70	23.3	20.3	56.3	28.0	8.31	<4.70	<4.70	<4.70	136
4/20/11	124177	Room 7A	<4.70	<4.70	14.8	<4.70	<4.70	<4.70	<4.70	<4.70	<4.70	<4.70	14.8
4/20/11	124178	Music	<4.73	<4.73	9.56	11.5	29.3	11.1	<4.73	<4.73	<4.73	<4.73	61.4
4/20/11	124179	Room 23	<4.69	<4.69	7.85	21.1	58.3	23.2	7.21	<4.69	<4.69	<4.69	117
4/20/11	124180	Room 23	<4.71	<4.71	13.2	14.2	25.1	15.8	<4.71	<4.71	<4.71	<4.71	68.3

4/20/11	124181	Room 31A	<4.71	<4.71	16.4	20.0	31.8	21.6	7.53	<4.71	<4.71	<4.71	97.0
4/20/11	124182	Kitchen	<4.58	<4.58	8.30	6.79	9.01	<4.58	<4.58	<4.58	<4.58	<4.58	24.1
4/20/11	124183	Office - Sandborne	<4.60	<4.60	14.4	11.4	22.5	6.99	<4.60	<4.60	<4.60	<4.60	55.3
4/20/11	124184	Office - Art	<4.68	<4.68	15.3	22.7	36.1	12.2	<4.68	<4.68	<4.68	<4.68	86.2
4/20/11	124185	Outdoors	<5.30	<5.30	<5.30	<5.30	<5.30	<5.30	<5.30	<5.30	<5.30	<5.30	<5.30
4/20/11	124186	Worker	<4.98	<4.98	<4.98	<4.98	<4.98	<4.98	<4.98	<4.98	<4.98	<4.98	<4.98
4/21/11	124187	Room 3	<4.44	<4.44	4.49	11.1	9.24	19.4	<4.44	<4.44	<4.44	<4.44	44.3
4/21/11	124188	Room 7B	<4.49	<4.49	17.6	12.9	18.3	8.33	<4.49	<4.49	<4.49	<4.49	57.3
4/21/11	124189	Room 20	<4.54	14.2	32.4	32.2	42.4	26.7	9.00	<4.54	<4.54	<4.54	157
4/21/11	124190	Room 20	<4.57	17.5	35.3	35.3	50.3	30.1	7.52	<4.57	<4.57	<4.57	175
4/21/11	124191	Room 25	<4.54	17.6	32.3	26.3	29.8	21.9	7.62	<4.54	<4.54	<4.54	135
4/21/11	124192	Room 31B	<4.59	<4.59	14.5	10.3	19.4	9.09	<4.59	<4.59	<4.59	<4.59	53.3
4/21/11	124193	Gym	<4.52	<4.52	<4.52	10.3	18.2	<4.52	<4.52	<4.52	<4.52	<4.52	28.5
4/21/11	124194	Teacher Work Roor	<4.54	<4.54	16.5	16.9	30.6	8.42	<4.54	<4.54	<4.54	<4.54	72.5
4/21/11	124195	Outdoors	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31	<5.31
4/21/11	124196	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
5/21/11	122860	Room 4	<4.20	22.8	41.7	39.0	54.0	45.9	13.0	<4.20	<4.20	<4.20	217
5/21/11	122861	Room 5	<4.20	<4.20	23.7	24.1	25.3	23.6	7.00	<4.20	<4.20	<4.20	103
5/21/11	122862	Room 11	<4.23	10.6	20.0	22.3	48.0	43.1	9.22	<4.23	<4.23	<4.23	153
5/21/11	122863	Room 19	<4.25	<4.25	32.3	20.7	47.8	25.3	5.46	<4.25	<4.25	<4.25	132
5/21/11	122864	Room 21B	<4.23	7.22	137	174	159	66.7	21.5	<4.23	<4.23	<4.23	567
5/21/11	122865	Room 22	<4.15	27.3	59.5	41.5	34.2	26.7	9.81	<4.15	<4.15	<4.15	199
5/21/11	122866	Room 22	<4.21	30.1	77.0	54.6	47.6	28.1	10.2	<4.21	<4.21	<4.21	248
5/21/11	122867	Room 26	<4.22	<4.22	16.2	13.2	19.6	9.12	<4.22	<4.22	<4.22	<4.22	58.1
5/21/11	122868	Room 27	<4.14	<4.14	9.86	<4.14	5.53	<4.14	<4.14	<4.14	<4.14	<4.14	15.4
5/21/11	122869	Room 39B	<4.20	<4.20	28.2	35.7	41.3	20.3	7.65	<4.20	<4.20	<4.20	133
5/21/11	122870	Teacher's Lounge	<4.24	9.41	23.8	29.2	33.6	16.8	4.63	<4.24	<4.24	<4.24	117
5/21/11	122871	Library	<4.15	20.5	48.0	54.6	51.9	25.4	7.83	<4.15	<4.15	<4.15	208
5/21/11	122872	Teacher Work Roor	<4.26	7.17	30.3	34.8	53.5	28.6	10.1	<4.26	<4.26	<4.26	164
5/21/11	122873	Sped Office	<4.27	<4.27	29.4	27.6	46.6	21.7	<4.27	<4.27	<4.27	<4.27	125
5/21/11	122874	Room C	<4.23	<4.23	27.8	31.8	43.9	27.6	6.19	<4.23	<4.23	<4.23	137
5/21/11	122875	Outdoors	<4.22	<4.22	4.38	<4.22	<4.22	<4.22	<4.22	<4.22	<4.22	<4.22	4.38
5/21/11	122876	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
6/9/11	121011	Library	<5.46	26.2	94.3	90.9	91.6	49.6	20.7	12.2	<5.46	<5.46	386
6/9/11	121012	Room 4	<5.51	8.83	22.9	24.5	36.5	40.6	18.7	<5.51	<5.51	<5.51	152
6/9/11	121013	Room 21B	<5.51	31.0	131	134	151	101	27.3	<5.51	<5.51	<5.51	576
6/9/11	121014	Room 21B	<5.53	38.3	139	137	163	107	28.0	<5.53	<5.53	<5.53	612

6/9/11	121015	Room 22	<5.53	33.9	56.8	54.1	64.8	63.4	18.1	<5.53	<5.53	<5.53	291
6/9/11	121016	Outdoors	<5.41	<5.41	<5.41	<5.41	<5.41	<5.41	<5.41	<5.41	<5.41	<5.41	<5.41
6/9/11	121017	Field Blank	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00

Sample Volur	Notes	Sample Conditions
1000		Summer conditions
1332		Summer conditions
1317		Summer conditions
1320		Summer conditions
1298		Summer conditions
1321		Summer conditions
1314		Summer conditions
1336		Summer conditions
1317		Summer conditions
1320		Summer conditions
1296		Following removal of caulk around exterior window frame
1296		Following removal of caulk around exterior window frame
1290		Following removal of caulk around exterior window frame
	Not analyzed	Following removal of caulk around exterior window frame
1000		Following removal of caulk around exterior window frame
1290		Following removal of caulk around exterior window frame
1287		Following removal of caulk around exterior window frame
1269		Following removal of caulk around exterior window frame
1269		Following removal of caulk around exterior window frame
1287		Following removal of caulk around exterior window frame
1293		Following removal of caulk around exterior window frame
1000		Following removal of caulk around exterior window frame
990		Following removal of caulk around exterior window frame
990		Following removal of caulk around exterior window frame
1272		Following removal of caulk around exterior window frame
1281		Following removal of caulk around exterior window frame
1321		Following removal of caulk around exterior window frame
1275		Following removal of caulk around exterior window frame
1000		Following removal of caulk around exterior window frame
1191		Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
1143		Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
1200		Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
1151		Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
1162		Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
1215		Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted

1190		Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
979		Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
1156		Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
1159		Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
1179		Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
1171		Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
1158		Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
936		Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
991		Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
909	Under Room	Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
934	Ceiling	Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
1000		Following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted
1230	Analyzed at a dilution due to the sample matrix	
1247	Analyzed at a dilution due to the sample matrix	
1266	Analyzed at a dilution due to the sample matrix	
1233	Analyzed at a dilution due to the sample matrix	
1229	Analyzed at a dilution due to the sample matrix	
1228	Analyzed at a dilution due to the sample matrix	
1216	Analyzed at a dilution due to the sample matrix	
1000	Analyzed at a dilution due to the sample matrix	
1137	Supplimental	Under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted
1171		Under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted
1205		Under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted
961	No supplimen	Under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted
1184		Under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted
1167		Under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted
1121		Under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted
1148		Under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted
1193		Under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted
1198		Under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted
1000		Under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted
1000		Under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted
1193		Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles
1156		Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
1116		Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
1146		Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
1107		Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.

1114		Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
1108		Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
1000	Ceiling	Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
807	Ceiling	Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
992	Ceiling	Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
1003	Ceiling	Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
1000		Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
1000		Under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
1172		
1215		
	NEA	
	NEA	
1132		Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
1136		Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
1146		Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
	NEA	Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
1144		Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
1141		Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
1135		Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
1130		Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
1125		Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
1000		Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
1000		Under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles
1168		Under isolation, encapsulation and air cleaner configurations
1158		Under isolation, encapsulation and air cleaner configurations
1155	UV Enclosure	Under isolation, encapsulation and air cleaner configurations
1163	I Beam Enclo	Under isolation, encapsulation and air cleaner configurations
1181		Under isolation, encapsulation and air cleaner configurations
1119	Window Encl	Under isolation, encapsulation and air cleaner configurations
1119		Under isolation, encapsulation and air cleaner configurations
1059	Window Encl	Under isolation, encapsulation and air cleaner configurations
1083	UV Discharge	Under isolation, encapsulation and air cleaner configurations
1107		Under isolation, encapsulation and air cleaner configurations
1000		Under isolation, encapsulation and air cleaner configurations
1131		Under isolation, encapsulation and air cleaner configurations
1112	I Beam	Under isolation, encapsulation and air cleaner configurations
1141	UV Discharge	Under isolation, encapsulation and air cleaner configurations

1147		Under isolation, encapsulation and air cleaner configurations
1092	Inside UV	Under isolation, encapsulation and air cleaner configurations
1112		Under isolation, encapsulation and air cleaner configurations
1138	UV Discharge	Under isolation, encapsulation and air cleaner configurations
1094	Dup	Under isolation, encapsulation and air cleaner configurations
903		Under isolation, encapsulation and air cleaner configurations
1000		Under isolation, encapsulation and air cleaner configurations
1162		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1181	Dup	Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1190		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1092		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1000		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1130		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1178		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1137		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1125		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1103		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
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1110		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1122		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1086		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1000		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1225		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1199		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1166		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1151		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1186		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1155		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1145		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
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1150		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
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936		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.

941		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
	Not reported (	Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
958		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
956		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
935		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
	Not reported (	Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
932		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
951		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
841		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
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926		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
912		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
915		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
907		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
903		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
847		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
861		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
861		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
837		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
833		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
840		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
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1128		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
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1062		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
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1068		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
944		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1003		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1125		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1113		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1101		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1094		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1101		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1089		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1107		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1101		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
941		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1000		Under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1191		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1191		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1182		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1177		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1181		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1203		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1188		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1184		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1207		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1190		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1180		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1205		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1174		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1172		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1182		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1186		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1000		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
915		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
908		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
908		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
905		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.

904		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
924		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
1000		Under summer outdoor air delivery, mini-wall, and full indoor caulk encapsulation.

FW: Report on Indoor Air Samples Collected on October 7, 2011, Estabrook Elementary School (EH&E 17892)
Patrick Goddard
to:
Kimberly Tisa
11/02/2011 09:13 AM
Cc:
"Matt Fragala"
Hide Details
From: "Patrick Goddard" <pgoddard@lexingtonma.gov>

To: Kimberly Tisa/R1/USEPA/US@EPA

Cc: "Matt Fragala" <MFragala@EHEinc.com>

1 Attachment

10.7.2011 Air Samples (EH&E 17892).pdf

Good Morning Kim,

I am forwarding to your attention the results of the October air samples. The samples we taken under operation conditions defined in O&M Plan, revision 3.

The results are well within the guidelines and we do not plan to sample again until December vacation.

We hope to hear from you in the near future on the suitability of the O&M Plan to operate the school for the next three years while our new school is being constructed.

Let me know if you have any questions.
Pat

Patrick W Goddard
Director of Public Facilities
Town of Lexington
201 Bedford Street
Lexington, MA 02420

781-274-8958
pgoddard@lexingtonma.gov

From: EH&E Production Department [mailto:ProductionDepartment@eheinc.com]

Sent: Thursday, October 27, 2011 4:39 PM
To: Patrick Goddard; Paul Ash
Cc: Matt Fragala; David MacIntosh
Subject: Report on Indoor Air Samples Collected on October 7, 2011, Estabrook Elementary School (EH&E 17892)

Mr. Goddard and Dr. Ash:

On behalf of Matt Fragala and David MacIntosh, please find the attached memorandum regarding the *Report on Indoor Air Samples Collected on October 7, 2011, at Estabrook Elementary School, Lexington, Massachusetts* (EH&E 17892) in Adobe Acrobat (.pdf) format.

The original document is to follow via the mail.

Environmental Health & Engineering, Inc.
Production Department
1-800-825-5343 (1-800-EHE-TALK)

ENVIRONMENTAL HEALTH & ENGINEERING

Environmental Health & Engineering, Inc.
117 Fourth Avenue
Needham, MA
02494-2725
TEL 800-825-5343
781-247-4300
FAX 781-247-4305
www.eheinc.com

MEMORANDUM

TO: Patrick Goddard, Director of Facilities, Town of Lexington
Paul B. Ash, Ph.D., Superintendent, Lexington Public Schools

FROM: Matt A. Fragala, M.S., C.I.H., Senior Scientist
David L. MacIntosh, Sc.D., C.I.H., Principal Scientist

DATE: October 27, 2011

RE: Report on Indoor Air Samples Collected on October 7, 2011, at Estabrook Elementary School, Lexington, Massachusetts (EH&E 17892)

This memorandum provides a description of the monitoring for polychlorinated biphenyls (PCBs) in indoor air of Estabrook Elementary School conducted on October 7, 2011.

SUMMARY OF FINDINGS

- The average concentration of the most recent round of air sampling is 78 nanograms per cubic meter (ng/m^3) with a maximum concentration of 114 ng/m^3
- Modifications made to room 21B were observed to effectively provide ventilation to the classroom. Airborne PCB concentrations and ventilation rates measured in room 21B on October 7, 2011, were similar to room 21A and other classrooms in the School.
- PCB concentrations in indoor air were below the threshold for follow-up assessment (173 ng/m^3) in all locations.
- Sampling results do not alter the estimated school year average range of 115 to 125 ng/m^3 presented in the August 29, 2011, memorandum.
- Three additional rounds of sampling for the 2011-2012 school year are planned for December 2011, April 2012, and June 2012.

BACKGROUND

As part of the Operations and Maintenance (O&M) Plan, multiple rounds of air sampling have been completed at the School. The objective of the air testing program is to evaluate PCB levels in indoor air of classrooms relative to performance criteria established in the O&M Plan and cited above. The O&M Plan developed for the School states that potential exposure to airborne PCBs shall be controlled to as low as reasonably achievable, and in all cases shall be less than the annual average value of 230 ng/m^3, the target established based on classrooms for children less than 6 years old. Also, a single measured concentration greater than 75% of the annual average target will initiate a follow-up assessment to determine the conditions contributing to the levels of PCBs in the air in that location. On October 7, 2011, EH&E issued a memorandum with a sampling schedule for the 2011-2012 school year based on suggestions from the Estabrook community and the Town of Lexington.

Conditions During Sampling

Mechanical systems in the School were operated in accordance with the O&M Plan. All indoor air sampling was conducted with windows and doors closed. Air samples were collected from approximately 8:30 a.m. – 3:30 p.m. on Friday, October 7, 2011. The average ambient temperature during the sampling period was 58 degrees Fahrenheit (°F). The thermostat in each room was set to 68 °F.

Air Sample Results

As shown in Table 1 (refer to attachment), PCB concentrations in indoor air of the rooms tested on October 7, 2011, ranged from 52 ng/m^3 to 114 ng/m^3. PCB concentrations for all samples were less than 173 ng/m^3, the threshold for follow-up assessment.

The plot in Figure 1 demonstrates the relationship between PCB concentrations in indoor air of Estabrook and ambient temperature for the period of November 4, 2010 – October 7, 2011. The average October 7, 2011, values are plotted in red. The October 7 air samples targeted an ambient temperature range not measured during previous rounds of sampling. The October 7 air sampling results are consistent with previous observations. These observations suggest that with mitigations measures in place and standardized ventilations rates, variation in ambient temperature appears to be an important determinant of PCB concentrations in indoor air of the school. Air sampling data collected later in the school year will be used to further evaluate the relationship between temperature and airborne PCB concentrations in the School.

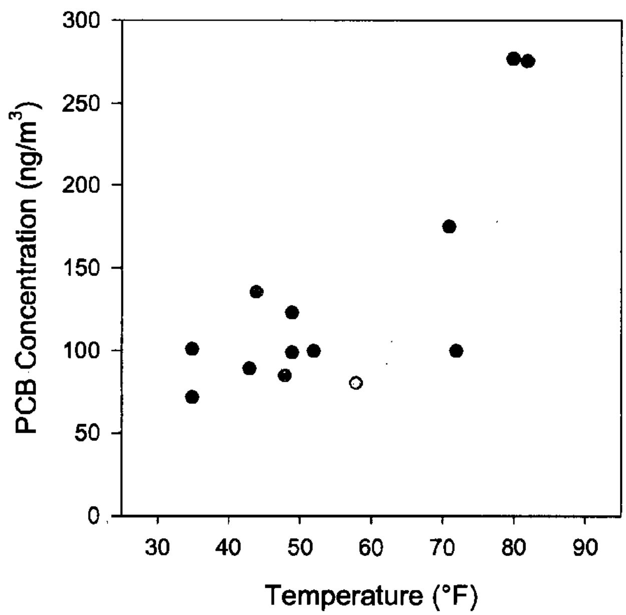

Figure 1 Average Indoor Air PCB Concentrations at Estabrook Elementary School Compared to Average Ambient Temperature during the Sampling Period (November 4, 2010 – October 7, 2011)

If you have any questions regarding this memorandum please do not hesitate to contact us at 1-800-TALK EHE (1-800-825-5343).

Attachment

Table 1 Air Sample Results for Total Polychlorinated Biphenyls, Estabrook Elementary School, 117 Grove Street, Lexington, Massachusetts, July 22, 2010 – October 7, 2011*

Sample Date:	2010												2011						
	July 22[a]	August 25-27[b]	September 6[c]	September 19[d]	September 27[e]	September 29[f]	October 18 and 19[g]	November 4[h]	November 11[i]	November 20[j]	November 24[k]	December 2[l]	February 23[m]	April 20 and 21[n]	May 21[o]	June 9[p]	July 13[q]	July 14[r]	October 7[s]
Location	**Total PCBs (ng/m^3)**																		
Room 1	299	426	118‡	63‡	76‡	153†	145	–	116	–	–	–	146	–	–	–	–	–	–
Room 2	–	775	455	189	166	253†	53	–	60	–	–	–	–	136	–	–	312	43	100
Room 3	–	–	–	–	–	364†	111	–	110	–	–	–	–	44	–	–	–	–	–
Room 4	–	–	–	–	–	344†	126	105	–	–	–	–	–	–	217	152	348**[AF]	237[AF]	114
Room 5	459	736	320	196	149	209†	79**	–	128	–	–	–	–	–	103	–	–	–	–
Room 6	1,800	764	483	171	213	383†	182	131**	–	–	–	–	97	–	–	–	9[WO]	163[WO]	–
Room 7A	–	–	5.19	–	–	–	–	–	–	–	34	–	–	15	–	–	–	–	–
Room 7B	–	–	–	–	–	–	–	–	–	–	<5.3	–	–	57	–	–	–	–	–
Room 7C	–	–	–	–	–	–	–	–	–	–	–	–	13**	–	–	–	–	–	–
Room 11	–	–	–	–	–	–	–	–	65	–	–	–	–	–	153	–	–	–	–
Room 13	319	340	184	155†	–	–	–	–	92**	–	–	–	94	–	–	–	–	–	57
Room 19	–	–	–	–	–	–	–	–	12	–	–	–	–	–	132	–	–	–	–
Room 20	–	–	–	–	–	–	–	–	–	57	–	–	–	167**	–	–	515[AF]	244[AF]	80
Room 21A	–	–	410	193	–	–	–	–	–	–	–	109	103	–	–	–	–	–	79
Room 21B	–	–	–	–	–	–	–	–	–	188	–	–	–	–	566	594**	–	–	66
Room 22	–	–	–	–	–	–	–	–	–	25	–	–	–	–	224**	291	337	177	–
Room 23	–	–	–	–	–	–	–	–	–	142	–	–	–	93**	–	–	–	–	–
Room 24	680	601	226	173†	–	–	–	–	–	106**	–	–	86	–	–	–	233[WO]	116[WO]	52
Room 25	–	–	–	–	–	–	–	–	–	130	–	–	–	135	–	–	–	–	–
Room 26	–	–	–	79	–	–	–	–	–	–	47	–	–	–	58	–	–	–	–
Room 27	–	–	–	–	–	–	–	–	–	–	69	–	–	–	15	–	–	–	–
Room 31A	562	575	444	–	–	282	–	–	–	94	–	–	–	97	–	–	175	78	75
Room 31B	–	–	–	–	–	–	–	–	–	135	–	–	–	52	–	–	202[WO]	65[WO]	–
Room 39B	–	419	–	–	–	–	–	–	–	64	–	–	–	–	132	–	179[AF]	45[AF]	66
Room 39C	342	495	245	100	–	–	–	–	–	125	–	–	76	–	–	–	–	–	–
Library	–	469	196	–	–	–	–	–	–	–	135	–	–	–	208	386	263[WO]	176[WO]	87**
Art/Music Room	–	–	194	–	–	–	–	–	–	–	–	30	–	61	–	–	–	–	–
Teacher Work Room	–	–	138	–	–	–	–	–	–	–	34	–	–	–	164	–	–	–	–
Admin. Offices	–	–	–	–	–	–	–	–	–	–	72	–	–	–	–	–	–	–	–
Sanborn Office	–	–	–	–	–	–	–	–	–	–	–	66	–	55	–	–	–	–	–
Teacher Lounge	–	–	–	–	–	–	–	–	–	89	–	–	–	–	117	–	–	–	–
Teacher Work Room	–	–	138	–	–	–	–	–	–	–	34	–	–	–	164	–	–	–	–
Admin. Offices	–	–	–	–	–	–	–	–	–	–	72	–	–	–	–	–	–	–	–
Sanborn Office	–	–	–	–	–	–	–	–	–	–	–	66	–	55	–	–	–	–	–
Teacher Lounge	–	–	–	–	–	–	–	–	–	89	–	–	–	–	117	–	–	–	–
Basement	–	–	227	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table 1 Continued

Sample Date:	2010												2011						
	July 22[a]	August 25-27[b]	September 6[c]	September 19[d]	September 27[e]	September 29[f]	October 18 and 19[g]	November 4[h]	November 11[i]	November 20[j]	November 24[k]	December 2[l]	February 23[m]	April 20 and 21[n]	May 21[o]	June 9[p]	July 13[q]	July 14[r]	October 7[s]
Location	**Total PCBs (ng/m^3)**																		
Ceiling plenum (39C)	–	–		562	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Gym	–	–	–	–	–	–	–	–	–	–	–	38	–	29	–	–	–	–	–
Sped Office	–	–	–	–	–	–	–	–	–	–	–	134	–	86	125	–	–	–	–
Room B	–	–	–	–	–	–	–	–	–	–	–	148	–	–	–	–	–	–	–
Kitchen	–	–	–	–	–	–	–	–	–	–	–	66	–	24	–	–	–	–	–
Room D	–	–	–	–	–	–	–	–	–	–	–	108	–	–	–	–	–	–	–
Hall Office (o/s Art)	–	–	–	–	–	–	–	–	–	–	–	125	–	–	–	–	–	–	–
Worker	–	–	–	–	–	–	–	–	–	–	–	–	–	<4.99	–	–	–	–	–
Room C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	137	–	–	–	–
Outdoors	<3.79	<5.00	<4.20	<4.46	<4.32	<4.44	<5.54	<4.58	<4.60	<4.08	<5.32	<5.95	<4.37	<5.31	4.38	<5.41	<4.99	<4.67	<10.4

PCB polychlorinated biphenyl
ng/m^3 nanograms per cubic meter
– air sample not collected at that location

[a] Initial round of sampling
[b] Samples collected following removal of caulk around exterior window frame
[c] Samples collected following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted.
[d] Samples collected under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted.
[e] Samples collected under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
[f] Samples collected under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles.
[g] Samples collected under isolation, encapsulation and air cleaner configurations.
[h] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[i] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[j] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[k] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[l] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[m] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[n] Samples collected under winter outdoor air delivery (70 °F set point), mini-wall, and full indoor caulk encapsulation. Windows closed.
[o] Samples collected under summer outdoor air delivery (70 °F set point, exhaust on at 6:00 a.m.), mini-wall, and full indoor caulk encapsulation. Windows closed.
[p] Samples collected under summer outdoor air delivery (63 °F set point, exhaust on at 6:00 a.m.), mini-wall, and full indoor caulk encapsulation. Windows closed.
[q] Samples collected under summer outdoor air delivery (63 °F set point, unit vents and exhaust on 24/7 as described in 8.29.11 Memo), mini-wall, and full indoor caulk encapsulation. Windows closed unless noted.
[r] Samples collected under summer outdoor air delivery (63 °F set point, unit vents and exhaust on 24/7 as described in 8.29.11 Memo), mini-wall, and full indoor caulk encapsulation. Windows closed unless noted.
[s] Samples collected under winter outdoor air delivery (68 °F set point, unit vents and exhaust on). Windows and doors closed.

* PCB concentration analysis performed by Alpha Analytical Inc., using U.S. Environmental Protection Agency (EPA) Method 10A (GC/MS-SIM).
** Average of sample and sample duplicate results
† Samples collected under minimum outdoor air delivery.
‡ Sample collected with supplemental air outdoor air (1,200 cubic feet per minute).
AF Sample collected with charcoal air filter running in the classroom.
WO Sample collected with classroom windows and doors open.

FW: Release Abatement Measure Completion Report -Estabrook ES

Patrick Goddard to: Kimberly Tisa 11/28/2011 12:18 PM

From: "Patrick Goddard" <pgoddard@lexingtonma.gov>
To: Kimberly Tisa/R1/USEPA/US@EPA

Kim,
As noted, see -email below from Cynthia Campisano on 11/4.
Pat

Patrick W Goddard
Director of Public Facilities
Town of Lexington
201 Bedford Street
Lexington, MA 02420

781-274-8958
pgoddard@lexingtonma.gov

-----Original Message-----
From: Matt Fragala [mailto:MFragala@EHEinc.com]
Sent: Monday, November 28, 2011 10:20 AM
To: Patrick Goddard
Cc: David MacIntosh
Subject: FW: Release Abatement Measure Completion Report-Estabrook ES

Hi Pat

The final soil report and this response to questions from EPA is missing from the admin record. I will send you a copy of the final soil report next.

Matt

-----Original Message-----
From: Cynthia Campisano
Sent: Friday, November 04, 2011 12:33 PM
To: 'Woodward.Katherine@epamail.epa.gov'
Cc: Tisa.Kimberly@epamail.epa.gov; Matt Fragala
Subject: RE: Release Abatement Measure Completion Report-Estabrook ES

Hi Kate,

Please see below for responses to your questions. Attached please find the final manifest as requested. If you prefer, I can also provide a memo or update for your records with the responses provided below. Please let me know if you would like a summary document or any other additional information. Thanks for your help.

Cynthia D. Campisano, PG
Senior Scientist/Project Executive
Environmental Health & Engineering, Inc.
781-247-4300

-----Original Message-----
From: Woodward.Katherine@epamail.epa.gov
[mailto:Woodward.Katherine@epamail.epa.gov]
Sent: Wednesday, October 26, 2011 12:05 PM

To: Cynthia Campisano
Cc: Tisa.Kimberly@epamail.epa.gov
Subject: Release Abatement Measure Completion Report-Estabrook ES

Cindee,

I reviewed the report and I have a couple of questions/comments before we can close out this portion of the project:

a. Page 4. Section 2.3. The statement is made that one sample collected outside of Classroom 6 had a PCB concentration of 7.4 ppm (refer to Figure B.3, Appendix B). Figure B.3 only has sample numbers. Which room is Classroom 6 and which of the samples has the 7.4 ppm concentration?

Response: Table F.1 summarizes all of the analytical data and provides location identifiers. The sample with a concentration of 7.4 ppm is identified as 113734, and Classroom 6 is adjacent to it.

b. Page 11.

i. Section 5.0. The last paragraph states that Figure B-3 illustrates the Site and excavation locations. Figure B-3 shows the sample locations but not the excavation locations. Figure B-4 shows the excavation locations, but does not show close up sample locations and grid spacings.

Response: Figure B.3 illustrates the excavation locations and the assessment sample locations that determined areas requiring excavation. The excavation locations are shaded in light purple. Subsequent drawings B.4 - B.7, provide more detailed illustrations of the excavation areas, including the sample IDs for clearance samples. The close-up illustrations of sample and grid locations are included in B.5-B.7.

ii. Section 5.1. The first paragraph again refers to Figure B-3 when discussing excavation limits.

Response: Same as previous.

c. Page 12. Table 5.1. What is the meaning of "S" and "D" in the column marked sample type?

Response: S = Sample; D = Duplicate

I also need a copy of the Non-hazardous Waste Manifest with Waste Tracking Number NHWM051637 that is signed by the designated facility owner.

If you have any questions please feel free to contact me.

Kate

Katherine Woodward, PE
Environmental Protection Agency
5 Post Office Square, Suite 100
Mail Code: OSRR07-2

Boston, MA 02109-3912
Phone: 617-918-1353

TOWN OF LEXINGTON

Department of Public Facilities

Patrick W. Goddard
Director of Public Facilities

Tel: (781) 274-8958
Email:pgoddard@lexingtonma.gov

December 8, 2011

Ms. Kimberly Tisa
PCB Coordinator
U. S. Environmental Protection Agency
Five Post Office Square, Suite 100
Boston, MA 02109-3912

RE: Estabrook School Short-Term PCB Risk-Based Disposal Approved Dated December 1, 2011

Dear Ms. Tisa:

This letter is intended as written notification of acceptance of the conditions included with the PCB Short-Term Risk-Based Approval for Estabrook Elementary School in Lexington, MA.

Sincerely,

Patrick Goddard, Director
Department of Public Facilities

CC: D. MacIntosh, EH&E
P. Ash, Superintendent of Schools
C. Valente, Town Manager

CERTIFIED MAIL™

PATRICK GODDARD
TOWN OF LEXINGTON
Department of Public Facilities
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Lexington, MA 02420

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PCB COORDINATOR
U.S.E.P.A.
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SUITE 100
BOSTON, MA
02109-3912

RETURN RECEIPT REQUESTED

7-2

PLACE STICKER AT TOP OF ENVELOPE TO THE RIGHT
OF THE RETURN ADDRESS, FOLD AT DOTTED LINE

9/29/11 Estabrook

K Tish
P. Goddard
M. Fragala
D MacIntosh

All soils were removed; verification samples all < 1 ppm.

Awareness training for staff has been conducted.

Precisid 55-70° data gaps
October 1st event

Revise O&M to reflect new sampling discussed 9/26
@ PTA meeting.

RE: Lexington Estabrook School & PCB Testing

Esty, Benjamin to: Kimberly Tisa 09/28/2011 10:01 AM

From: "Esty, Benjamin" <besty@hbs.edu>
To: Kimberly Tisa/R1/USEPA/US@EPA

Dear Ms. Tisa:

Thanks for your very prompt reply--I appreciate it.

I do hope you will push very hard to verify the critical, yet largely unsubstantiated assumption of "identical classrooms" underlying the EH&E analysis and the town's Operation and Maintenance Plan. In this case, the cost of verification (additional testing) seems very low compared to the cost of being wrong (young children being exposed to known hazards). With another 20-25 tests on "at risk" classrooms and in varying temperature conditions, I think we will learn considerably more and will provide a much greater level of confidence for concerned parents. As we get new test results, I hope the proposed O&M plan has contingencies built into it regarding what to do if we get more surprising and alarming results.

Again, I am very willing to discuss my concerns or explore the statistical analysis with you or an EPA statistician, as you see appropriate.

Regards,
Ben Esty

Ben Esty
4 Ballard Terrace
Lexington, MA 02420
Ph: (781) 274-6350
E-mail: besty@hbs.edu-----Original Message-----
From: Tisa.Kimberly@epamail.epa.gov [mailto:Tisa.Kimberly@epamail.epa.gov]
Sent: Wednesday, September 28, 2011 6:35 AM
To: Patrick Goddard
Cc: Esty, Benjamin; dmacintosh@eheinc.com
Subject: RE: Lexington Estabrook School & PCB Testing

Thank you for the information, Mr. Goddard.

I did receive Mr. Esty's e-mail regarding increasing the air samples to be collected as part of Estabrook's LT O&M plan. EPA recognizes and appreciates the school's commitment to ensuring a safe environment for students and staff at Estabrook.

With that said, EPA is reviewing your recent air testing results and the revised O&M plan (with inclusion of the additional samples proposed below.) Should I have any questions or require any additional information on the plan, I will give you a call. I also would appreciate seeing the October sampling plan prior to its implementation.

As I indicated in our discussion in August, I would like to have a further discussion with Dr. MacIntosh regarding methods. If there is an opportunity either tomorrow or next week, I would appreciate a call to discuss further.

Should you have any further questions, please don't hesitate to call.

Kimberly N. Tisa
U.S. Environmental Protection Agency
5 Post Office Square, Suite 100
Mail Code: OSRR07-2
Boston, MA 02109-3912

Phone: 617.918.1527
E-Fax: 617.918.0527

tisa.kimberly@epa.gov

From: "Patrick Goddard" <pgoddard@lexingtonma.gov>
To: "Esty, Benjamin" <besty@hbs.edu>, Kimberly Tisa/R1/USEPA/US@EPA
Cc: <dmacintosh@eheinc.com>
Date: 09/27/2011 06:27 PM
Subject: RE: Lexington Estabrook School & PCB Testing

Ms. Tisa,

We held a PTA meeting last night to discuss status of the PCB effort at Estabrook School and the progress on the MSBA Feasibility Study to address school deficiencies identified in the Statement of Interest.

As you recall, after having very stable PCB measurements throughout the winter, we saw increased measures during May and June. Our Advisory Committee and EH&E developed additional tests to determine if we could determine if we could lower these readings. Through these additional tests EH&E reported that the increase in ambient temperature appeared to be the cause of the increased PCB measures, and that by implementing four changes in our O&M Plan we could manage the concentration and achieve a school year average of approximately 115 to 125 ng/m3.

These changes were included in the recently submitted version 2 of the O&M Plan. We have not changed the number of air samples in the O&M Plan through all three versions.

Last night several parents asked for the number of air samples to be increased so that more information could be obtained on specific classrooms. The Superintendent, Dr. Ash, assured the audience that we would increase the number of samples from the 27 in the O&M Plan to about 40 since this was a concern for the parents.

EH&E is now developing a sampling plan for October so that we can have a set of sample that are in the 60/70 F ambient range to fill in "gaps" in the ambient temperature/ PCB ng/m3 profile and to increase the number of samples to meet the concerns expressed by Estabrook parents.

As I mentioned last week, I believe we have submitted all of the information requested in order for the O&M Plan to be reviewed. Let me know if you would like to discuss any of the information.

Mr. Esty, thank you for copying myself and Dr. MacIntosh on your correspondence with Ms. Tisa.

Regards,

Pat Goddard

From: Esty, Benjamin [mailto:besty@hbs.edu]
Sent: Tuesday, September 27, 2011 12:50 PM
To: tisa.kimberly@epa.gov
Cc: Patrick Goddard; dmacintosh@eheinc.com
Subject: Lexington Estabrook School & PCB Testing
Importance: High

Dear Ms. Tisa:

As the parent of a child in Lexington's Estabrook Elementary School, I am writing to urge that you require additional air testing at the school over the coming school year largely as a matter of science, but also as a matter of assurance for concerned parents. I raised this issue at last night's school committee/PTA meeting, and seem to have gotten agreement from Dr. Ash (the superintendent) and the environmental consultants—I deeply appreciate their willingness to consider additional testing. That said, I am writing you with the hope that you will reinforce the need for additional testing rather than approving a much lower level of air testing as recommended in the town's revised Operation and Maintenance Plan (O&M plan). Without a doubt, there has been an enormous amount of work done on this matter by the town, the school officials, and your office for which we are very grateful. We all have the same goal—a safe and effective learning environment—and I believe we are headed in that direction, with just a few disagreements on the correct path forward.

After completing approximately 240 air samples tests last year, the town's revised "Operation and Maintenance Plan" calls for something like only 27 tests this coming year. A 90% reduction in air testing does not seem appropriate in the face of the somewhat surprising and very troubling results observed in June and July 2011. (See the attached sheet showing the test results for rooms 2, 4, 20, 21B, 22, and the library).

The plan submitted by the town and its environmental consultants (EH&E) makes one critical assumption: all of the classrooms are identical (i.e., they have equal levels of PCP contamination). Based on this one key assumption, they propose a testing methodology for the coming year and a forecasting methodology that shows the average classroom will have an average contamination rate below the 230ng/m3 limit prescribed by your office. Yet we know from past test results (see attached), that some rooms have had dramatically higher PCP levels over time, and we are still observing dramatically different levels in the most recent tests (July 2011). Moreover, at least two of the rooms in question (Rooms 2 and 4) house the smallest (and therefor most vulnerable) children—the kindergarten classes. These children have the lowest exposure thresholds and, therefore, require extra protection.

Unfortunately, and critically, EH&E does not have sufficient within room data to justify the claim that all rooms are identical. While it is possible that the rooms are identical (i.e., they are not statistically different), a much more likely explanation is that the consultants have employed (and are relying upon for their proposed maintenance plan) weak statistical tests that are not able to differentiate PCP levels among the various rooms: with only 3-5 observations per classroom since November 2010, the tests don't have the ability to distinguish one classroom form another. In statistical terms, they have used VERY low power tests, and are unable to reject the null hypothesis that the rooms are equivalent. As a result, we may have a very serious "type II" error here.

A second, but less important issue is the impact of temperature. Most of post-remediation testing has been done in cold-weather when PCP emissions are lower. The recent warm weather tests illustrate the need for more warm and moderate temperature testing.

From my perspective, both as a parent and as someone who has studied a lot of statistics, the obligation should be to protect the children in the worst rooms, not in the average room. We need to know that all children (and staff) are safe, not just the children in the average or the low contamination rooms. And testing levels of >500ng/m3 really deserve greater investigation and a higher burden of proof. In short, I just don't feel comfortable with the assumption that all rooms are equal and don't think EH&H has met the burden of proof to asset this claim or to utilize this very critical assumption.

I therefore ask you to review this issue before approving the revised O&M plan for Estabrook School. A possible action plan would be to ask for ~20 additional tests in addition to the ones currently planned by EH&E. Ideally, these additional tests would be completed very soon:

1) Early October (as soon as possible), test rooms 2, 4, 20, 21B, 22, and the library
2) Early November, test rooms 1, 3, 5, 6, 13, 21A, 24, 39B, and 39C
3) Early December test the teacher work rooms, art room, music room, SPED office, and Hall office

Even with ~50 tests (27 planned plus ~20 additional), we are still showing a dramatic reduction in the number of tests from last year (we are still down ~80% in testing). I think the additional testing will go a long way in appeasing nervous parents on this very emotional, very complicated, and very serious issue.

I would be happy to discuss this matter with you if that is appropriate.

Regards,
Ben Esty

Ben Esty
4 Ballard Terrace
Lexington, MA 02420
Ph: (781) 274-6350
E-mail: besty@hbs.edu

RE: Lexington Estabrook School & PCB Testing
Patrick Goddard
to:
Esty, Benjamin, Kimberly Tisa
09/27/2011 06:27 PM
Cc:
dmacintosh
Hide Details
From: "Patrick Goddard" <pgoddard@lexingtonma.gov>

To: "Esty, Benjamin" <besty@hbs.edu>, Kimberly Tisa/R1/USEPA/US@EPA

Cc: <dmacintosh@eheinc.com>

Ms. Tisa,

We held a PTA meeting last night to discuss status of the PCB effort at Estabrook School and the progress on the MSBA Feasibility Study to address school deficiencies identified in the Statement of Interest.

As you recall, after having very stable PCB measurements throughout the winter, we saw increased measures during May and June. Our Advisory Committee and EH&E developed additional tests to determine if we could determine if we could lower these readings. Through these additional tests EH&E reported that the increase in ambient temperature appeared to be the cause of the increased PCB measures, and that by implementing four changes in our O&M Plan we could manage the concentration and achieve a school year average of approximately 115 to 125 ng/m3.

These changes were included in the recently submitted version 2 of the O&M Plan. We have not changed the number of air samples in the O&M Plan through all three versions.

Last night several parents asked for the number of air samples to be increased so that more information could be obtained on specific classrooms. The Superintendent, Dr. Ash, assured the audience that we would increase the number of samples from the 27 in the O&M Plan to about 40 since this was a concern for the parents.

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From: Esty, Benjamin [mailto:besty@hbs.edu]
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I would be happy to discuss this matter with you if that is appropriate.

Regards,
Ben Esty

Ben Esty
4 Ballard Terrace
Lexington, MA 02420
Ph: (781) 274-6350
E-mail: besty@hbs.edu

ENVIRONMENTAL HEALTH & ENGINEERING

Environmental Health
& Engineering, Inc.
117 Fourth Avenue
Needham, MA
02494-2725

TEL 800-825-5343
781-247-4300
FAX 781-247-4305

MEMORANDUM

TO: Patrick Goddard, Director of Facilities, Town of Lexington
Paul B. Ash, Ph.D., Superintendent, Lexington Public Schools

FROM: David L. MacIntosh, Sc.D., Principal Scientist
Matt A. Fragala, M.S., C.I.H., Senior Scientist
Taeko Minegishi, M.S., Staff Scientist

DATE: September 16, 2011

RE: Effectiveness of Mitigation Measures at Estabrook Elementary School, Lexington, Massachusetts (EH&E 17892)

This memorandum provides an analysis of the effectiveness of mitigation measures for polychlorinated biphenyls (PCBs) in indoor air of Estabrook Elementary School (Estabrook), Lexington, Massachusetts. In earlier communications, Environmental Health & Engineering, Inc. (EH&E) demonstrated that these interventions led to lower concentrations of PCBs in indoor air of the school.[1] In this memorandum, the mitigation methods are evaluated further in consideration of the relationship between ambient temperature and indoor air PCB levels described in EH&E's memorandum of August 29, 2011.

Three primary interventions intended to reduce concentrations of PCBs in indoor air were implemented between August 25 and September 29, 2010:

1. Increased flow of outdoor air through unit ventilators and exhaust via central fans.
2. Encapsulation of visible PCB caulk with polyethylene tape and silicone caulk.
3. Encapsulation of PCB caulk located behind unit ventilators and convective heaters.

Indoor air samples from multiple classrooms were collected before and after each intervention and analyzed for total PCBs. The monitoring data were used to evaluate the effect of each

[1] September 10, 2010, Project Update; September 24, 2010, memorandum; October 12, 2010, memorandum

intervention. The results of this analysis are presented below and details on the methods are provided as an Attachment.

As shown in Table 1, each of the interventions produced a statistically significant reduction in concentrations of PCBs in indoor air of the school, controlling for differences in ambient temperature between the pre- and post-intervention monitoring.

Table 1 Median Concentrations of Polychlorinated Biphenyls in Indoor Air Before and After Implementation of Three Mitigation Measures, Estabrook Elementary School, Lexington, Massachusetts

Monitoring Period		Number of Rooms	Median (ng/m^3)[1]	p-value
Ventilation[2]				
Pre:	August 25 – 27, 2010	9	522	<0.01
Post:	September 6, 2010	9	188	
Partial Encapsulation[3]				
Pre:	September 6, 2010	9	346	0.02
Post:	September 19, 2010	7	263	
Full Encapsulation[4]				
Pre:	September 19, 2010	7	263	0.02
Post:	September 29, 2010	5	166	

ng/m^3 nanograms per cubic meter

1 Median of temperature-normalized and ventilation-normalized concentrations (see Attachment A)
2 Ventilation rates were adjusted by replacing filters and repairing fans in the unit ventilators. PCB concentration normalized to temperature only.
3 PCB-containing caulk along the interior face of transite panels open to classrooms was covered with adhesive-backed polyethylene tape and sealed with silicone caulk.
4 PCB-containing caulk located behind unit ventilators and convective heaters was covered with adhesive-backed polyethylene tape and sealed with silicone caulk.

The results of this analysis confirm the earlier findings and demonstrate that the mitigation measures employed in the autumn of 2010 were effective at controlling PCB levels in indoor air of the school, independent of the influence of ambient temperature. In other words, significant differences in indoor air PCB concentrations before and after each intervention remain after accounting for differences in ambient temperature on the days that the pre- and post-intervention samples were collected.

Subsequent to these interventions, mini-walls were constructed over all transite panels throughout Estabrook in November 2010. These walls are composed of aluminum-backed insulation and gypsum wallboard sealed with silicone caulk and paint. The mini-walls provide a physical barrier between the PCB caulk and the building interior. These barriers complement the previous encapsulation and prevent direct contact with the underlying caulk or encapsulating materials.

If you have any questions regarding this memorandum, please do not hesitate to contact any of us at 1-800-TALK EHE (1-800-825-5343).

Attachment

METHODS

A retrospective analysis was conducted of the effectiveness of three methods used in the fall of 2010 to mitigate concentrations of polychlorinated biphenyls (PCBs) in indoor air of Estabrook Elementary School (Estabrook):

1. Increased flow of outdoor air through unit ventilators and exhaust via central fans.
2. Encapsulation of visible PCB caulk with polyethylene tape and silicone caulk.
3. Encapsulation of PCB caulk behind unit ventilators and convective heaters

Indoor air samples from multiple classrooms were collected before and after each intervention and analyzed for total PCBs. The monitoring data were used to test the null hypothesis that the median PCB levels in indoor air before and after an intervention were equal. To ensure comparability of data between monitoring periods, the analysis was based on classrooms (and the library) that are located in the original building and that have unit ventilators. The Wilcoxon Rank Sum test was used to evaluate the equality of median concentrations between monitoring periods. To account for the effect of temperature on PCB levels in indoor air, pre- and post-intervention results were normalized to 71 degrees Fahrenheit (°F). For tests of encapsulation efficacy, pre- and post-intervention results were also normalized to a ventilation rate of 400 cubic feet per minute (cfm). The procedures used to normalize concentrations by temperature and ventilation rate are explained as follows.

CONCEPTUAL MODEL

As described in earlier Environmental Health & Engineering, Inc. (EH&E) communications, each indoor air sample was collected over a 6 to 7-hour period with the doors and windows of classrooms closed. Under these conditions, PCB concentrations in indoor air of classrooms can be characterized as a single-compartment system. For this model, PCB concentrations are assumed to be at steady-state during the sampling period. PCB levels in indoor air can therefore be described by Equation 1.

$$C = G/\dot{V} \qquad \text{Equation 1}$$

C = steady-state concentration of PCBs in indoor air (nanograms per cubic meter [ng/m^3])
G = emission rate of PCBs to indoor air (ng/min)
$\dot{V}$ = outdoor air ventilation rate (cubic meter per minute [m^3/min])

The emission rate (G in Equation 1) is the amount of a compound that moves from a surface to air over a certain interval of time. G is a mass transfer rate and has units of mass per time. The emission rate to air of any organic compound, including PCBs, is a function of vapor pressure. In turn, vapor pressure of a compound is determined by temperature.

The outdoor air ventilation rate ($\dot{V}$ in Equation 1) is the amount of outdoor air entering a room over a certain length of time. When doors and windows of classrooms are closed and the unit ventilator is operating (as was the case during all indoor air sampling), the outdoor air ventilation rate is equal to the flow rate of air through the outdoor air intake.

Rationale and Approach

Both the emission rate of PCBs and flow rate of outdoor air for the Estabrook classrooms are known to vary over time. This variability complicates the assessment of the efficacy of a mitigation method. Normalizing pre- and post-concentrations of PCBs in indoor air for effects of temperature and ventilation addresses this complication. Comparing pre- and post-mitigation concentrations that are normalized for temperature and ventilation provides an enhanced evaluation of the effectiveness of a mitigation method for controlling concentrations of PCBs in indoor air of the school.

Measured concentrations were normalized for temperature from the Clausius-Clapeyron equation, empirical data compiled by Li (2003),[1] the back pressure model for flux described by Jayjock model (1994),[2] and the PCB homolog composition of PCBs (the commercial mixture of PCBs that most closely resembles PCBs in caulk at Estabrook). The resulting flux of PCBs is directly proportional to temperature as follows:

---

[1] Li N, Wania F, Ying LD, and Daly GL. 2003. *A Comprehensive and Critical Compilation, Evaluation, and Selection of Physical-Chemical Property Data for Selected Polychlorinated Biphenyls.* Toronto Canada: University of Toronto at Scarborough. Department of Physical and Environmental Sciences. October 2, 2003.

[2] Jayjock MA. 1994. Back Pressure Modeling of Indoor Air Concentrations from Volatilizing Sources. *American Industrial Hygiene Association Journal.* 55: 230-235. March 1994.

$$LN\ (Flux) = 3.0 \times 10^{-5} - 9{,}852.7 \times 1/Temperature \qquad \text{Equation 2}$$

Flux = the rate of PCB emission per surface area (ng/m^2-min)

Temperature = ambient temperature in degrees Kelvin

The mass transfer rate (G in Equation 1) is directly proportional to flux and therefore the temperature-normalized emission rate (G_2) can be calculated from the observed emission rate (G_1) and the ratio of flux at the standard temperature (71 °F) and the temperature on the day of sampling:

$$G_2 = G_1 \frac{Flux_2}{Flux_1} \qquad \text{Equation 3}$$

To normalize to a standard ventilation rate, outdoor air ventilation rates were adjusted to a standard value of 11 m^3/min (400 cubic feet per minute [cfm]) from measurements made for each room and sampling event.

Finally, a normalized concentration ($C_{71°F,\ 400cfm}$) can be calculated from a measured concentration (C_1) according to Equation 4:

$$C_{71°F,\ 400cfm} = C_1 \times \frac{G_{71°F} \times \dot{V}_1}{G_1 \times \dot{V}_{400cfm}} \qquad \text{Equation 4}$$

Example

Data from Room 2 are used to provide an example of the procedure used to normalize concentrations based on temperature and ventilation rate.

Effect of Ventilation

Ventilation rates were increased in Room 2 from 5.9 m^3/min (209 cfm) on August 26, 2010, to 11.0 m^3/min (390 cfm) on September 6, 2010. To evaluate the effect of increased ventilation on PCBs in the air of the classroom, concentrations measured before and after the change in ventilation were normalized to a temperature of 71 °F. The difference between the temperature-normalized concentration of August 26, 2010, and September 6, 2010, indicates the effectiveness of increasing ventilation.

On August 26, 2010, the ambient temperature was 77 °F, the ventilation rate in Room 2 was 5.9 m^3/min (209 cfm), and the airborne PCB concentration in Room 2 was 775 ng/m^3. From Equation 1, the emission rate (G_1) on August 26 was 4,584 ng/min. From Equation 3, the emission rate (G_2) normalized to 71 °F is 3,087 ng/min.[3] The temperature-normalized concentration ($C_{71\,°F}$) on August 26, 2010, is calculated from Equation 4 as:

$$C_{71\,°F\text{—Aug }26} = 775\,\frac{ng}{m^3} \times \frac{3{,}087\frac{ng}{min}}{4{,}584\frac{ng}{min}} = 522\frac{ng}{m^3}$$

On September 6, 2010, the ambient temperature was 75 °F, the ventilation rate in Room 2 was 11.0 m^3/min (390 cfm), and the airborne PCB concentration in Room 2 was 455 ng/m^3. From Equation 1, the emission rate (G_1) on September 6, 2010, was 5,026 ng/min and from Equation 3 the emission rate (G_2) normalized to 71 °F is 3,861 ng/min. The temperature-normalized concentration ($C_{71\,°F}$) on September 6, 2010, is calculated as:

$$C_{71\,°F\text{—Sep }6} = 455\,\frac{ng}{m^3} \times \frac{3{,}861\frac{ng}{min}}{5{,}026\frac{ng}{min}} = 350\frac{ng}{m^3}$$

In summary, the temperature normalized PCB concentration in Room 2 is 522 ng/m^3 on August 26, 2010, and 350 ng/m^3 on September 6, 2010. The indoor PCB concentration is estimated to have been reduced by 33% as a result of increasing the outdoor air ventilation in Room 2.

Effect of Partial Encapsulation

Visible PCB caulk along the interior face of transite panels in Room 2 was encapsulated between September 10 and September 16, 2010. To evaluate the effect of that encapsulation on airborne PCBs in the classroom, concentrations measured before and after the encapsulation were normalized to a temperature of 71 °F and ventilation rate of 11.3 m^3/min

[3] The values reported here were calculated electronically and carried 15 digits of precision. Results calculated by hand may differ due to rounding.

(400 cfm). The difference between the normalized concentrations indicates the effectiveness of the encapsulation.

On September 6, 2010, the ambient temperature was 75 °F, the ventilation rate in Room 2 was 11.0 m^3/min (390 cfm), and the airborne PCB concentration in Room 2 was 455 ng/m^3. The corresponding values on September 19, 2010, were 70 °F, 14.7 m^3/min (520 cfm), and 189 ng/m^3. From Equation 1, the emission rates on September 6 and September 19 were 5,026 ng/min and 2,790 ng/min, respectively. The emission rates at 71 °F on September 6 and September 19 would have been 3,861 ng/min and 2,980 ng/min, respectively. The temperature and ventilation-normalized concentrations on September 6 and September 19 are:

$$C_{71\,°F\;400\;cfm—Sept\;6} = 455\,\frac{ng}{m^3} \times \frac{3{,}861\,\frac{ng}{min} \times 11.0\,\frac{m^3}{min}}{5{,}026\,\frac{ng}{min} \times 11.3\,\frac{m^3}{min}} = 340\,\frac{ng}{m^3}$$

$$C_{71\,°F\;400\;cfm—Sept\;19} = 189\,\frac{ng}{m^3} \times \frac{2{,}980\,\frac{ng}{min} \times 14.7\,\frac{m^3}{min}}{2{,}790\,\frac{ng}{min} \times 11.3\,\frac{m^3}{min}} = 263\,\frac{ng}{m^3}$$

The indoor PCB concentration is estimated to have been reduced by 23% as a result of partial encapsulation in Room 2.

8/4/2011

Estabrook Update

Dave McIntosh
Matt Pragala
Pat Goddard

- Add'l samples collected 7/13-14/11
  Rm 21 originally 1 room but was ÷ into 2 rooms 21A/21B
  21A had mechanical ventilation but 21B didn't.

→ Last yr. Supplemental air (1200 cfm) was added in winter but wasn't replaced in the spring/summer.

To amend ventilation issue in 21B, working on designing partial wall rather than full wall to allow ventilator to vent both rooms.

- opening windows
- adjusted thermostat setpoint to 63°F (calls for ↑ air)
- changed op. schedule such that vents ran 24/7 rather than just school hours (~ 8 AERate/hr) ← central exhaust system
- 174 ng/m³ avg (65-260 ng/m³) 4 rooms of data

main factor appears to be ambient temp influencing indoor air concentrations.

RE: Estabrook Data Summary
Matt Fragala to: Kimberly Tisa
Cc: "David MacIntosh", "Patrick Goddard"

08/01/2011 01:57 PM

From: "Matt Fragala" <MFragala@EHEinc.com>
To: Kimberly Tisa/R1/USEPA/US@EPA
Cc: "David MacIntosh" <DMacIntosh@eheinc.com>, "Patrick Goddard" <pgoddard@lexingtonma.gov>

Our call has been scheduled for this Thursday (August 4th) at 9:30 AM.

Here is the call-in information:

PARTICIPANT:
Call in Number: 1-800-391-1709
Conference Bridge# 420290

Matt

-----Original Message-----
From: Kimberly Tisa [mailto:Tisa.Kimberly@epamail.epa.gov]
Sent: Monday, August 01, 2011 1:33 PM
To: Matt Fragala
Cc: David MacIntosh; Patrick Goddard
Subject: RE: Estabrook Data Summary

I have a meeting in Worcester the afternoon of August 4. Is it a possibility to do the call the morning of August 4?

Kimberly N. Tisa
U.S. Environmental Protection Agency
5 Post Office Square, Suite 100
Mail Code: OSRR07-2
Boston, MA 02109-3912

Phone: 617.918.1527
E-Fax: 617.918.0527

tisa.kimberly@epa.gov

From: "Matt Fragala" <MFragala@EHEinc.com>
To: Kimberly Tisa/R1/USEPA/US@EPA
Cc: "David MacIntosh" <DMacIntosh@eheinc.com>, "Patrick Goddard" <pgoddard@lexingtonma.gov>
Date: 08/01/2011 10:26 AM
Subject: RE: Estabrook Data Summary

Hi Kim

I hope you had a nice vacation. Are you available to speak with us this Thursday (August 4th) afternoon for an update on Estabrook?

Matt
-----Original Message-----
From: Kimberly Tisa [mailto:Tisa.Kimberly@epamail.epa.gov]
Sent: Wednesday, July 20, 2011 8:00 AM
To: Matt Fragala
Cc: David MacIntosh; Patrick Goddard
Subject: RE: Estabrook Data Summary

Unfortunately, starting tomorrow afternoon I'm on vacation until August 1. We can schedule something for that week if you wish. My concern is the schedule for school re-opening.

Kimberly N. Tisa
U.S. Environmental Protection Agency
5 Post Office Square, Suite 100
Mail Code: OSRR07-2
Boston, MA 02109-3912

Phone: 617.918.1527
E-Fax: 617.918.0527

tisa.kimberly@epa.gov

From: "Matt Fragala" <MFragala@EHEinc.com>
To: Kimberly Tisa/R1/USEPA/US@EPA, "David MacIntosh" <DMacIntosh@eheinc.com>, "Patrick Goddard" <pgoddard@lexingtonma.gov>
Date: 07/19/2011 10:35 AM
Subject: RE: Estabrook Data Summary

Hi Kim

We did receive your email. I will coordinate with Dave and Pat to set up a conference call to discuss our action plan. Please email me some days and times that you are available for a call and I will set it up.

Matt
-----Original Message-----
From: Kimberly Tisa [mailto:Tisa.Kimberly@epamail.epa.gov]
Sent: Tuesday, July 19, 2011 9:12 AM
To: Matt Fragala; David MacIntosh; Patrick Goddard
Subject: Re: Estabrook Data Summary

I have not heard from anyone regarding the recent air sampling results at Estabrook and proposed next steps as noted in my 7/8 e-mail.

I wanted to confirm that you had received my e-mail. I also would like an update on what actions are being taken/evaluated.

Thank you.

Kimberly N. Tisa
U.S. Environmental Protection Agency
5 Post Office Square, Suite 100
Mail Code: OSRR07-2
Boston, MA 02109-3912

Phone: 617.918.1527
E-Fax: 617.918.0527

tisa.kimberly@epa.gov

From: Kimberly Tisa/R1/USEPA/US
To: "Matt Fragala" <MFragala@EHEinc.com>
Cc: "David MacIntosh" <DMacIntosh@eheinc.com>, "Patrick

Goddard"
<pgoddard@lexingtonma.gov>
Date: 07/08/2011 09:18 AM
Subject: Re: Estabrook Data Summary

Let's have a conversation on the proposed next steps. It's July and in order to issue any approvals for the IRM's is problematic given that indoor air still appears problematic.

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Everything needs to be accounted for in the O&M, in some way so that what has been identified doesn't get lost.

Kimberly N. Tisa
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Phone: 617.918.1527
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tisa.kimberly@epa.gov

From: "Matt Fragala" <MFragala@EHEinc.com>
To: Kimberly Tisa/R1/USEPA/US@EPA
Cc: "Patrick Goddard" <pgoddard@lexingtonma.gov>, "David MacIntosh" <DMacIntosh@eheinc.com>
Date: 07/06/2011 04:43 PM
Subject: Estabrook Data Summary

Hi Kim

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I hope this information is helpful. Feel free to contact me if you have any questions.

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Senior Scientist
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FAX 781-247-4305

[attachment "Estabrook PCB Table - Air and Bulk.xls" deleted by Kimberly Tisa/R1/USEPA/US] [attachment "Memorandum 070511 (EH&E 17228).pdf" deleted by Kimberly Tisa/R1/USEPA/US]

Lexington Estabrook School & PCB Testing
Esty, Benjamin
to:
Kimberly Tisa
09/27/2011 12:49 PM
Cc:
"Patrick Goddard (pgoddard@lexingtonma.gov)", "dmacintosh@eheinc.com"
Hide Details
From: "Esty, Benjamin" <besty@hbs.edu>

To: Kimberly Tisa/R1/USEPA/US@EPA

Cc: "Patrick Goddard (pgoddard@lexingtonma.gov)" <pgoddard@lexingtonma.gov>, "dmacintosh@eheinc.com" <dmacintosh@eheinc.com>

1 Attachment

Estabrook Air Sample Results to 7-14-11.pdf

Dear Ms. Tisa:

As the parent of a child in Lexington's Estabrook Elementary School, I am writing to urge that you require additional air testing at the school over the coming school year largely as a matter of science, but also as a matter of assurance for concerned parents. I raised this issue at last night's school committee/PTA meeting, and seem to have gotten agreement from Dr. Ash (the superintendent) and the environmental consultants—I deeply appreciate their willingness to consider additional testing. That said, I am writing you with the hope that you will reinforce the need for additional testing rather than approving a much lower level of air testing as recommended in the town's revised Operation and Maintenance Plan (O&M plan). Without a doubt, there has been an enormous amount of work done on this matter by the town, the school officials, and your office for which we are very grateful. We all have the same goal—a safe and effective learning environment—and I believe we are headed in that direction, with just a few disagreements on the correct path forward.

After completing approximately 240 air samples tests last year, the town's revised "Operation and Maintenance Plan" calls for something like only 27 tests this coming year. A 90% reduction in air testing does not seem appropriate in the face of the somewhat surprising and very troubling results observed in June and July 2011. (See the attached sheet showing the test results for rooms 2, 4, 20, 21B, 22, and the library).

The plan submitted by the town and its environmental consultants (EH&E) makes <u>one</u> critical assumption: all of the classrooms are identical (i.e., they have equal levels of PCP contamination). Based on this one key assumption, they propose a testing methodology for the coming year and a forecasting methodology that shows the average classroom will have an average contamination rate below the 230ng/m3 limit prescribed by your office. Yet we know from past test results (see attached), that some rooms have had dramatically higher PCP levels over time, and we are still observing dramatically different levels in the most recent tests (July 2011). Moreover, at least two of the rooms in question (Rooms 2 and 4) house the smallest (and therefor most vulnerable) children—the kindergarten classes. These children have the lowest exposure thresholds and, therefore, require extra protection.

Unfortunately, and critically, EH&E does not have sufficient within room data to justify the claim that all rooms are identical. While it is possible that the rooms are identical (i.e., they are not statistically different), a much more likely explanation is that the consultants have employed (and are relying upon for their proposed maintenance plan) weak statistical tests that are not able to differentiate PCP levels among the various rooms: with only 3-5 observations per classroom since November 2010, the tests don't have the ability to distinguish one classroom form another. In statistical terms, they have used VERY low power tests, and are unable to reject the null hypothesis that the rooms are equivalent. As a result, we may have a very serious "type II" error here.

A second, but less important issue is the impact of temperature. Most of post-remediation testing has been done in cold-weather when PCP emissions are lower. The recent warm weather tests illustrate the need for more warm and moderate temperature testing.

From my perspective, both as a parent and as someone who has studied a lot of statistics, the obligation should be to protect the children in the worst rooms, not in the average room. We need to know that all children (and staff) are safe, not just the children in the average or the low contamination rooms. And testing levels of >500ng/m3 really deserve greater investigation and a higher burden of proof. In short, I just don't feel comfortable with the assumption that all rooms are equal and don't think EH&H has met the burden of proof to asset this claim or to utilize this very critical assumption.

I therefore ask you to review this issue before approving the revised O&M plan for Estabrook School. A possible action plan would be to ask for ~20 additional tests in addition to the ones currently planned by EH&E. Ideally, these additional tests would be completed very soon:

1) Early October (as soon as possible), test rooms 2, 4, 20, 21B, 22, and the library
2) Early November, test rooms 1, 3, 5, 6, 13, 21A, 24, 39B, and 39C
3) Early December test the teacher work rooms, art room, music room, SPED office, and Hall office

Even with ~50 tests (27 planned plus ~20 additional), we are still showing a dramatic reduction in the number of tests from last year (we are still down ~80% in testing). I think the additional testing will go a long way in appeasing nervous parents on this very emotional, very complicated, and very serious issue.

I would be happy to discuss this matter with you if that is appropriate.

Regards,
Ben Esty

Ben Esty
4 Ballard Terrace
Lexington, MA 02420
Ph: (781) 274-6350

E-mail: besty@hbs.edu

Table 1 Air Sample Results for Total Polychlorinated Biphenyls, Estabrook Elementary School, 117 Grove Street, Lexington, Massachusetts, July 22, 2010 – July 14, 2011*

Sample Date:	2010												2011					
	July 22[a]	August 25-27[b]	September 6[c]	September 19[d]	September 27[e]	September 29[f]	October 18 and 19[g]	November 4[h]	November 11[i]	November 20[j]	November 24[k]	December 2[l]	February 23[m]	April 20 and 21[n]	May 21[o]	June 9[p]	July 13[q]	July 14[r]
Location	Total PCBs (ng/m^3)																	
Room 1	299	426	118[‡]	63[‡]	76[‡]	153[†]	145	–	116	–	–	–	146	–	–	–	–	–
Room 2	–	775	455	189	166	253[†]	53	–	60	–	–	–	–	136	–	–	312	43
Room 3	–	–	–	–	–	364[†]	111	–	110	–	–	–	–	44	–	–	–	–
Room 4	–	–	–	–	–	344[†]	126	105	–	–	–	–	–	–	217	152	348**[AF]	237[AF]
Room 5	459	736	320	196	149	209[†]	79**	–	128	–	–	–	–	–	103	–	–	–
Room 6	1,800	764	483	171	213	383[†]	182	131**	–	–	–	–	97	–	–	–	9[WO]	163[WO]
Room 7A	–	–	5.19	–	–	–	–	–	–	–	34	–	–	15	–	–	–	–
Room 7B	–	–	–	–	–	–	–	–	–	–	<5.3	–	–	57	–	–	–	–
Room 7C	–	–	–	–	–	–	–	–	–	–	–	–	13**	–	–	–	–	–
Room 11	–	–	–	–	–	–	–	–	65	–	–	–	–	–	153	–	–	–
Room 13	319	340	184	155[†]	–	–	–	–	92**	–	–	–	94	–	–	–	–	–
Room 19	–	–	–	–	–	–	–	–	12	–	–	–	–	–	132	–	–	–
Room 20	–	–	–	–	–	–	–	–	–	57	–	–	–	167**	–	–	515[AF]	244[AF]
Room 21A	–	–	410	193	–	–	–	–	–	–	–	109	103	–	–	–	–	–
Room 21B	–	–	–	–	–	–	–	–	–	188	–	–	–	–	566	594**	–	–
Room 22	–	–	–	–	–	–	–	–	–	25	–	–	–	–	224**	291	337	177
Room 23	–	–	–	–	–	–	–	–	–	142	–	–	–	93**	–	–	–	–
Room 24	680	601	226	173[†]	–	–	–	–	–	106**	–	–	86	–	–	–	233[WO]	116[WO]
Room 25	–	–	–	–	–	–	–	–	–	130	–	–	–	135	–	–	–	–
Room 26	–	–	–	79	–	–	–	–	–	–	47	–	–	–	58	–	–	–
Room 27	–	–	–	–	–	–	–	–	–	–	69	–	–	–	15	–	–	–
Room 31A	562	575	444	–	–	282	–	–	–	94	–	–	–	97	–	–	175	78
Room 31B	–	–	–	–	–	–	–	–	–	135	–	–	–	52	–	–	202[WO]	65[WO]
Room 39B	–	419	–	–	–	–	–	–	–	64	–	–	–	–	132	–	179[AF]	45[AF]
Room 39C	342	495	245	100	–	–	–	–	–	125	–	–	76	–	–	–	–	–
Library	–	469	196	–	–	–	–	–	–	–	135	–	–	–	208	386	263[WO]	176[WO]
Art/Music Room	–	–	194	–	–	–	–	–	–	–	–	30	–	61	–	–	–	–
Teacher Work Room	–	–	138	–	–	–	–	–	–	–	34	–	–	–	164	–	–	–
Admin. Offices	–	–	–	–	–	–	–	–	–	–	72	–	–	–	–	–	–	–
Sanborn Office	–	–	–	–	–	–	–	–	–	–	–	66	–	55	–	–	–	–
Teacher Lounge	–	–	–	–	–	–	–	–	–	89	–	–	–	–	117	–	–	–
Teacher Work Room	–	–	138	–	–	–	–	–	–	–	34	–	–	–	164	–	–	–
Admin. Offices	–	–	–	–	–	–	–	–	–	–	72	–	–	–	–	–	–	–
Sanborn Office	–	–	–	–	–	–	–	–	–	–	–	66	–	55	–	–	–	–
Teacher Lounge	–	–	–	–	–	–	–	–	–	89	–	–	–	–	117	–	–	–
Basement	–	–	227	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table 1 Continued

Sample Date:	2010												2011					
	July 22[a]	August 25-27[b]	September 6[c]	September 19[d]	September 27[e]	September 29[f]	October 18 and 19[g]	November 4[h]	November 11[i]	November 20[j]	November 24[k]	December 2[l]	February 23[m]	April 20 and 21[n]	May 21[o]	June 9[p]	July 13[q]	July 14[r]
Location	Total PCBs (ng/m^3)																	
Ceiling plenum (39C)	–	–		562	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Gym	–	–	–	–	–	–	–	–	–	–	–	38	–	29	–	–	–	–
Sped Office	–	–	–	–	–	–	–	–	–	–	–	134	–	86	125	–	–	–
Room B	–	–	–	–	–	–	–	–	–	–	–	148	–	–	–	–	–	–
Kitchen	–	–	–	–	–	–	–	–	–	–	–	66	–	24	–	–	–	–
Room D	–	–	–	–	–	–	–	–	–	–	–	108	–	–	–	–	–	–
Hall Office (o/s Art)	–	–	–	–	–	–	–	–	–	–	–	125	–	–	–	–	–	–
Worker	–	–	–	–	–	–	–	–	–	–	–	–	–	<4.99	–	–	–	–
Room C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	137	–	–	–
Outdoors	<3.79	<5.00	<4.20	<4.46	<4.32	<4.44	<5.54	<4.58	<4.60	<4.08	<5.32	<5.95	<4.37	<5.31	4.38	<5.41	<4.99	<4.67

PCB polychlorinated biphenyl
ng/m^3 nanograms per cubic meter
– air sample not collected at that location

[a] Initial round of sampling
[b] Samples collected following removal of caulk around exterior window frame
[c] Samples collected following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted.
[d] Samples collected under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted.
[e] Samples collected under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
[f] Samples collected under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles.
[g] Samples collected under isolation, encapsulation and air cleaner configurations.
[h] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[i] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[j] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[k] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[l] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[m] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[n] Samples collected under winter outdoor air delivery (70 °F set point), mini-wall, and full indoor caulk encapsulation. Windows closed.
[o] Samples collected under summer outdoor air delivery (70 °F set point, exhaust on at 8:00 a.m.), mini-wall, and full indoor caulk encapsulation. Windows closed.
[p] Samples collected under summer outdoor air delivery (63 °F set point, exhaust on at 6:00 a.m.), mini-wall, and full indoor caulk encapsulation. Windows closed.
[q] Samples collected under summer outdoor air delivery (63 °F set point, unit vents and exhaust on 24/7 as described in 8.29.11 Memo), mini-wall, and full indoor caulk encapsulation. Windows closed unless noted.
[r] Samples collected under summer outdoor air delivery (63 °F set point, unit vents and exhaust on 24/7 as described in 8.29.11 Memo), mini-wall, and full indoor caulk encapsulation. Windows closed unless noted.

* PCB concentration analysis performed by Alpha Analytical Inc., using U.S. Environmental Protection Agency (EPA) Method 10A (GC/MS-SIM).
** Average of sample and sample duplicate results
† Samples collected under minimum outdoor air delivery.
‡ Sample collected with supplemental air outdoor air (1,200 cubic feet per minute).
AF Sample collected with charcoal air filter running in the classroom.
WO Sample collected with classroom windows and doors open.

To: "Matt Fragala" <MFragala@EHEinc.com>
Cc: "David MacIntosh" <DMacIntosh@eheinc.com>, "Patrick Goddard" <pgoddard@lexingtonma.gov>
Bcc:
Subject: RE: Estabrook Data Summary

Unfortunately, starting tomorrow afternoon I'm on vacation until August 1. We can schedule something for that week if you wish. My concern is the schedule for school re-opening.

Kimberly N. Tisa
U.S. Environmental Protection Agency
5 Post Office Square, Suite 100
Mail Code: OSRR07-2
Boston, MA 02109-3912

Phone: 617.918.1527
E-Fax: 617.918.0527

tisa.kimberly@epa.gov

"Matt Fragala" Hi Kim We did receive your email. I will coordin... 07/19/2011 10:35:29 AM

From: "Matt Fragala" <MFragala@EHEinc.com>
To: Kimberly Tisa/R1/USEPA/US@EPA, "David MacIntosh" <DMacIntosh@eheinc.com>, "Patrick Goddard" <pgoddard@lexingtonma.gov>
Date: 07/19/2011 10:35 AM
Subject: RE: Estabrook Data Summary

Hi Kim

We did receive your email. I will coordinate with Dave and Pat to set up a conference call to discuss our action plan. Please email me some days and times that you are available for a call and I will set it up.

Matt
-----Original Message-----
From: Kimberly Tisa [mailto:Tisa.Kimberly@epamail.epa.gov]
Sent: Tuesday, July 19, 2011 9:12 AM
To: Matt Fragala; David MacIntosh; Patrick Goddard
Subject: Re: Estabrook Data Summary

I have not heard from anyone regarding the recent air sampling results at Estabrook and proposed next steps as noted in my 7/8 e-mail.

I wanted to confirm that you had received my e-mail. I also would like an update on what actions are being taken/evaluated.

Thank you.

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FAX 781-247-4305

[attachment "Estabrook PCB Table - Air and Bulk.xls" deleted by Kimberly Tisa/R1/USEPA/US] [attachment "Memorandum 070511 (EH&E 17228).pdf" deleted by Kimberly Tisa/R1/USEPA/US]

Estabrook Data Summary
Matt Fragala
to:
Kimberly Tisa
07/06/2011 04:43 PM
Cc:
"Patrick Goddard", "David MacIntosh"
Hide Details
From: "Matt Fragala" <MFragala@EHEinc.com>

To: Kimberly Tisa/R1/USEPA/US@EPA

Cc: "Patrick Goddard" <pgoddard@lexingtonma.gov>, "David MacIntosh" <DMacIntosh@eheinc.com>

History: This message has been replied to.

2 Attachments

Estabrook PCB Table - Air and Bulk.xls Memorandum 070511 (EH&E 17228).pdf

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MEMORANDUM

TO: Patrick Goddard, Director of Facilities, Town of Lexington
Paul B. Ash, Ph.D., Superintendent, Lexington Public Schools
Estabrook Advisory Committee

FROM: Matt A. Fragala, M.S., C.I.H., Senior Scientist
David L. MacIntosh, Sc.D., C.I.H., Principal Scientist

DATE: July 5, 2011

RE: End of School Year Report on Indoor Air, Including Samples Collected on May 21 and June 9, 2011, Estabrook Elementary School (EH&E 17228)

This memorandum provides a description of the monitoring for polychlorinated biphenyls (PCBs) in indoor air of Estabrook Elementary School during the 2010-2011 school year. The topics summarized here include: (i) the most recent rounds of samples collected on May 21, and June 9, 2011; (ii) school-year average concentrations relative to the established benchmark; and (iii) plans for further evaluation of mitigation opportunities during summer 2011. This memorandum begins with a summary of the findings, which is followed by details on each of the topics.

SUMMARY OF FINDINGS

- The final rounds of air sampling for the 2010-2011 school year were completed on May 21 and June 9, 2011. Considering those results and all results from prior sampling, the school-wide average concentration of PCBs in indoor air over the 2010-2011 school year was 151 nanograms per cubic meter of air (ng/m^3); 34% below the benchmark concentration of 230 ng/m^3.

- Since encapsulating and enclosing the source materials in November 2010, 82 school-day average air samples have been collected. All concentrations were less than the threshold for follow-up assessment (173 ng/m^3) except for eight samples collected in four rooms. Seven of the eight samples were collected in the two most recent rounds of monitoring.

- Ventilation and temperature have been identified as factors that contributed to the change in concentrations observed in the two most recent rounds of monitoring.

- Methods for further control of PCB levels in indoor air will be evaluated during summer 2011 with the objective of making refinements to the O&M Plan.

BACKGROUND

Details of the interim measures and other aspects of the current indoor environmental quality (IEQ) management plan are available in the Project Update memorandum dated October 28, 2010, and the materials distributed to the Superintendent's Advisory Committee on November 4, 2010. In addition, detailed plans on the operation of Estabrook are available in the O&M Plan dated January 29, 2011. In brief, a mini-wall was constructed in each room to enclose the lower panels of the curtain wall. The mini-wall separates the panels and associated PCB-containing materials from indoor air of the classroom. I-beam chases were also enclosed and specific areas related to the curtain wall were sealed with new caulk or foam insulation. Areas sealed included edges of the mini-wall, metal-to-metal joints of aluminum framing, and original caulking at the intersection of horizontal and vertical aluminum frames. Interim measures were completed in Estabrook by the end of November 2010.

As part of the O&M Plan, multiple rounds of air sampling have been completed at the School during the 2010-2011 School year. The objective of the air testing program is to evaluate PCB levels in indoor air of classrooms relative to performance criteria established in the O&M Plan and cited above. The O&M Plan developed for the School states that potential exposure to airborne PCBs shall be controlled to as low as reasonably achievable, and in all cases shall be less than the annual average value of 230 ng/m^3, the target established based on classrooms for children less than 6 years old. Also, a single measured concentration greater than 75% of the annual average target will initiate a follow-up assessment to determine the conditions contributing to the levels of PCBs in the air in that location.

SCHOOL-WIDE AND ROOM-SPECIFIC CONCENTRATIONS: 2010-2011

Since the completion of interim mitigation measures in November 2010 and through the latest sampling, the school-wide average airborne PCB concentration for the period is 121 ng/m^3, 47% lower than the target for school-year average concentrations in the school. When sampling conducted since the first day of the 2010-2011 school year is included, the school-wide average for the year is 151 ng/m^3, also below the target level.

The estimated time-weighted average (TWA) concentration for each classroom sampled in 2010-2011 was also below the target concentration of 230 ng/m^3. In Room 21B, the TWA concentration was 227 ng/m^3, a value that closely approaches the Estabrook target for children less than 6 years old, but still below the targets recommended by the U.S. Environmental Protection Agency of 300 ng/m^3 for children older than 6 years and 450 ng/m^3 for adults.

PCB concentrations in indoor air were below the threshold for follow-up assessment (173 ng/m^3) in all but four of the rooms sampled between November 2010 and June 2011 (see Figure 1). Ninety percent (74 of 82) of the school-day average air samples collected over that time were below the threshold for follow-up assessment. Seven of the eight samples with concentrations above the threshold for follow-up were collected during the two most recent rounds of monitoring. Those rounds of monitoring are discussed below.

MAY 21 AND JUNE 9, 2011 SAMPLING ROUNDS

Conditions During Sampling

As in previous rounds, all indoor air sampling in May and June 2011 was conducted with windows and doors closed. Air samples were collected from approximately 8:30 a.m. – 3:00 p.m. on Saturday, May 21, 2011, and from approximately 12:30 p.m. to 6:00 p.m. on Thursday, June 9, 2011. The average ambient temperature during the two sampling periods was 71 degrees Fahrenheit (°F) and 76 °F, respectively.

At the end of the school day on May 20, 2011, operation of the ventilation systems was switched from winter conditions to summer conditions. The thermostat in each room was set to 70 °F and the steam boiler was turned off. The exhaust system began operation at 8:00 a.m. on May 21, 2011, rather than the regularly scheduled time of 6:00 a.m.

Ventilation conditions were refined during the week of June 6, 2011, prior to the June 9, 2011, round of air sampling. The thermostat in each room was set to 63 °F and the exhaust system was tied into the summer mode switch and set to turn on and off in sequence with other components of the ventilation system.

Air Sample Results

As shown in Table 1 (refer to attachment), PCB concentrations in indoor air of the rooms tested in May and June 2011 ranged from 15 ng/m^3 to 612 ng/m^3. PCB concentrations for twelve of the eighteen samples were less than 173 ng/m^3, the threshold for follow-up assessment. Levels in rooms 4, 21B, 22, and the Library were greater than 173 ng/m^3 and initiated a follow-up assessment. The absence of mechanical ventilation in Room 21B is known to contribute to the concentrations observed in that room. The set point of the thermostat in each room and the corresponding delivery of outdoor air by the unit ventilators is suspected of contributing to the elevated levels observed on May 21, 2011, as well. The effect of temperature on volatilization of PCBs also appears to be a factor in the concentrations measured on May 21 and June 9, 2011. This follow-up is anticipated to be completed in July of 2011. The goal of this action is to evaluate additional techniques to control airborne PCBs to levels as low as reasonably achievable. The planned activities are described below.

MITIGATION ACTIVITIES

As described above, indoor air PCB concentrations measured in 4 rooms during May and June 2011 require follow-up evaluation based on criteria provided in the O&M Plan. Ventilation and temperature have been identified as factors that contributed to the change in concentrations. Means of controlling the effects of these factors will be implemented and tested in July 2011. At this time, four mitigation activities have been identified for evaluation:

- Add ventilation to room 21B. Currently room 21B does not have a unit ventilator. Previous testing indicates that ventilation is effective at controlling airborne PCB concentrations.

- Increase ventilation rates during periods of high outdoor air temperature – currently determined to be school-day average temperature greater than 70 °F. Two techniques for increasing ventilation rates during warm weather months of June and September 2011 will be evaluated: 1) running the HVAC system 24-hours-a-day; and 2) opening windows and classroom doors. According to Estabrook staff opening windows and doors is common practice during periods of warm weather. Thus, evaluation of ventilation associated with that practice and also the effect on PCB levels in indoor air will be conducted.

- Further evaluate use of air cleaning devices to removing PCBs from indoor air. Testing conducted in 2010 indicated that the charcoal air filters effectively reduced PCB concentrations in classroom air. Noise produced by the devices and potential disruption of classroom activities was a limitation of their use. The intent of the additional testing will be to evaluate the effectiveness of operating air cleaning devices at a sound level that is not disruptive.

- Evaluate a noiseless approach for air cleaning. The use of passive capture by activated charcoal air may provide a reduction in PCB concentrations in classroom air without creating disruptive noise. A scoping analysis consisting of mathematical modeling will be undertaken. Depending on the results, a proof of concept test may be conducted.

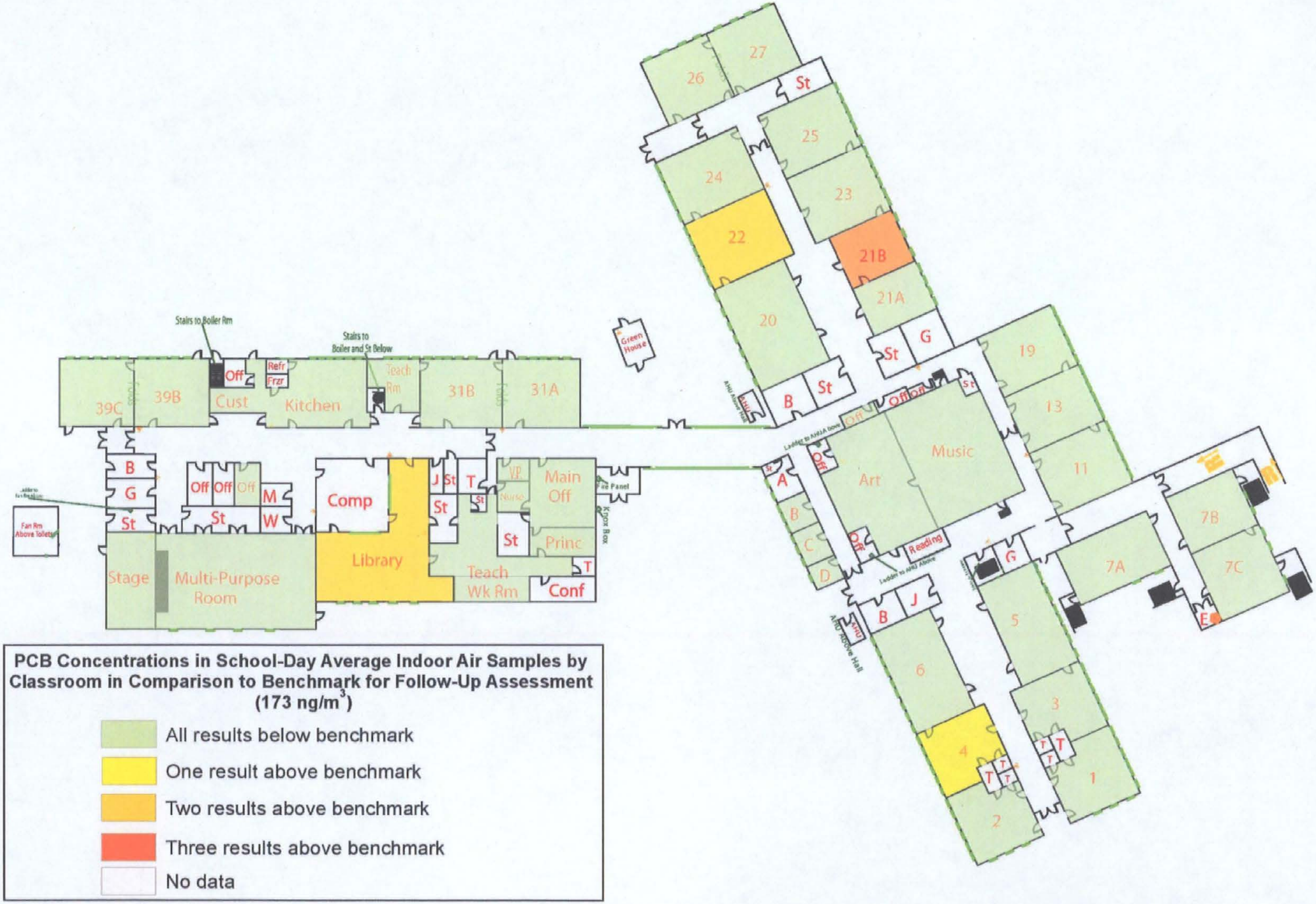
Follow-up sampling will be conducted to evaluate the effectiveness of the mitigation activities by analyzing the data for spatial trends (e.g., by room or wing), temporal trends (e.g., season), and associations related to temperature and ventilation conditions.

SUMMARY

Monitoring for PCBs in indoor air of Estabrook Elementary School during the 2010-2011 school year as required by the O&M Plan was completed in June 2011. The school-wide average concentration of PCBs in indoor air over the 2010-2011 school year was 151 ng/m^3 and below the benchmark concentration of 230 ng/m^3. Since encapsulating and enclosing the source materials in November 2010, 82 school-day average air samples were collected and all concentrations were less than the threshold for follow-up assessment (173 ng/m^3) except for eight samples collected in four rooms. Seven of the eight samples were collected in the two most recent rounds of monitoring. Temperature and ventilation have been identified as a cause of the increase in concentrations. Methods for further control of PCB levels in indoor air will be evaluated during summer 2011 with the objective of making refinements to the O&M Plan.

If you have any questions regarding this memorandum please do not hesitate to contact us at 1-800-TALK EHE (1-800-825-5343).

Attachments



PCB Concentrations in School-Day Average Indoor Air Samples by Classroom in Comparison to Benchmark for Follow-Up Assessment ($173\ ng/m^3$)
All results below benchmark
One result above benchmark
Two results above benchmark
Three results above benchmark
No data
Stairs to Boiler Rm
Stairs to Boiler and St Below
39C
39B
Off
Cust
Refr
Frzr
Kitchen
Teach Rm
31B
31A
B
G
St
Off
Off
Off
M
W
St
Comp
J
St
T
St
VP
Nurse
Main Off
St
Princ
T
Conf
Teach Wk Rm
Library
Stage
Multi-Purpose Room
Fan Rm Above Toilets
Green House
Knox Box
26
27
St
25
24
23
22
21B
21A
20
St
G
B
St
19
13
11
Off
Off
Off
Off
St
Music
Art
A
B
C
D
Off
Reading
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6
5
7A
7B
7C
E
3
4
T
T
1
2
AHU Above Hall

Table 1 Air Sample Results for Total Polychlorinated Biphenyls, Estabrook Elementary School, 117 Grove Street, Lexington, Massachusetts, September 6, 2010 – June 9, 2011*

Sample Location	Total PCBs (ng/m³)													
	Pre-miniwall					Post-miniwall								
	September 6, 2010[a]	September 19, 2010[b]	September 27, 2010[c]	September 29, 2010[d]	October 18 and 19, 2010[e]	November 4, 2010[f]	November 11, 2010[g]	November 20, 2010[h]	November 24, 2010[i]	December 2, 2010[j]	February 23, 2011[k]	April 20 and 21, 2011[l]	May 21, 2011[m]	June 9, 2011[n]
Room 1	118[‡]	63[‡]	76[‡]	153[†]	145	–	116	–	–	–	146	–	–	–
Room 2	455	189	166	253[†]	53	–	60	–	–	–	–	136	–	–
Room 3	–	–	–	364[†]	111	–	110	–	–	–	–	44	–	–
Room 4	–	–	–	344[†]	126	105	–	–	–	–	–	–	217	152
Room 5	320	196	149	209[†]	79**	–	128	–	–	–	–	–	103	–
Room 6	483	171	213	383[†]	182	131**	–	–	–	–	97	–	–	–
Room 7A	5.19	–	–	–	–	–	–	–	34	–	–	15	–	–
Room 7B	–	–	–	–	–	–	–	–	<5.3	–	–	57	–	–
Room 7C	–	–	–	–	–	–	–	–	–	–	13**	–	–	–
Room 11	–	–	–	–	–	–	65	–	–	–	–	–	153	–
Room 13	184	155[†]	–	–	–	–	92**	–	–	–	94	–	–	–
Room 19	–	–	–	–	–	–	12	–	–	–	–	–	132	–
Room 20	–	–	–	–	–	–	–	57	–	–	–	167**	–	–
Room 21A	410	193	–	–	–	–	–	–	–	109	103	–	–	–
Room 21B	–	–	–	–	–	–	–	188	–	–	–	–	566	594**
Room 22	–	–	–	–	–	–	–	25	–	–	–	–	224**	291
Room 23	–	–	–	–	–	–	–	142	–	–	–	93**	–	–
Room 24	226	173[†]	–	–	–	–	–	106**	–	–	86	–	–	–
Room 25	–	–	–	–	–	–	–	130	–	–	–	135	–	–
Room 26	–	79	–	–	–	–	–	–	47	–	–	–	58	–
Room 27	–	–	–	–	–	–	–	–	69	–	–	–	15	–
Room 31A	444	–	–	282	–	–	–	94	–	–	–	97	–	–
Room 31B	–	–	–	–	–	–	–	135	–	–	–	52	–	–
Room 39B	–	–	–	–	–	–	–	64	–	–	–	–	132	–
Room 39C	245	100	–	–	–	–	–	125	–	–	76	–	–	–
Library	196	–	–	–	–	–	–	–	135	–	–	–	208	386
Art/Music Room	194	–	–	–	–	–	–	–	–	30	–	61	–	–
Teacher Work Room	138	–	–	–	–	–	–	–	34	–	–	–	164	–
Admin. Offices	–	–	–	–	–	–	–	–	72	–	–	–	–	–
Sanborn Office	–	–	–	–	–	–	–	–	–	66	–	55	–	–
Teacher Lounge	–	–	–	–	–	–	–	89	–	–	–	–	117	–
Basement	227	–	–	–	–	–	–	–	–	–	–	–	–	–
Ceiling plenum (39C)	562	–	–	–	–	–	–	–	–	–	–	–	–	–

Table 1 Continued

Sample Location	Total PCBs (ng/m³)													
	Pre-miniwall					Post-miniwall								
	September 6, 2010[a]	September 19, 2010[b]	September 27, 2010[c]	September 29, 2010[d]	October 18 and 19, 2010[e]	November 4, 2010[f]	November 11, 2010[g]	November 20, 2010[h]	November 24, 2010[i]	December 2, 2010[j]	February 23, 2011[k]	April 20 and 21, 2011[l]	May 21, 2011[m]	June 9, 2011[n]
Gym	–	–	–	–	–	–	–	–	–	38	–	29	–	–
Sped Office	–	–	–	–	–	–	–	–	–	134	–	86	125	–
Room B	–	–	–	–	–	–	–	–	–	148	–	–	–	–
Kitchen	–	–	–	–	–	–	–	–	–	66	–	24	–	–
Room D	–	–	–	–	–	–	–	–	–	108	–	–	–	–
Hall Office (Outside Art)	–	–	–	–	–	–	–	–	–	125	–	–	–	–
Worker	–	–	–	–	–	–	–	–	–	–	–	<4.99	–	–
Room C	–	–	–	–	–	–	–	–	–	–	–	–	137	–
Outdoors	<4.20	<4.46	<4.32	<4.44	<5.54	<4.58	<4.60	<4.08	<5.32	<5.95	<4.37	<5.31	4.38	<5.41

PCB polychlorinated biphenyl
ng/m^3 nanograms per cubic meter
– air sample not collected at that location

[a] Samples collected following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted.
[b] Samples collected under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted.
[c] Samples collected under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
[d] Samples collected under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles.
[e] Samples collected under isolation, encapsulation and air cleaner configurations.
[f] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[g] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[h] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[i] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[j] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[k] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[l] Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[m] Samples collected under summer outdoor air delivery (70 °F set point, exhaust on at 8:00 AM), mini-wall, and full indoor caulk encapsulation.
[n] Samples collected under summer outdoor air delivery (63 °F set point, exhaust on at 6:00 AM), mini-wall, and full indoor caulk encapsulation.

* PCB concentration analysis performed by Alpha Analytical Inc., using U.S. Environmental Protection Agency (EPA) Method 10A (GC/MS-SIM).
† Samples collected under minimum outdoor air delivery.
‡ Sample collected with supplemental air outdoor air (1,200 cubic feet per minute).
** Average of sample and sample duplicate results

RE: FW: O&M Plan for PCBs, Estabrook School (EH&E 17228)
Patrick Goddard to: Kimberly Tisa 06/13/2011 09:20 AM

Kim,
EH&E is on site sampling today, so I don't want to try to change anything at this point.
Pat

Patrick W Goddard
Director of Public Facilities
Town of Lexington
201 Bedford Street
Lexington, MA 02420

781-274-8958
pgoddard@lexingtonma.gov

-----Original Message-----
From: Tisa.Kimberly@epamail.epa.gov
[mailto:Tisa.Kimberly@epamail.epa.gov]
Sent: Monday, June 13, 2011 9:17 AM
To: Patrick Goddard
Subject: RE: FW: O&M Plan for PCBs, Estabrook School (EH&E 17228)

Thanks. The units originally were in meters and not in feet....thus the difference in the #'s of samples.

Another alternative is doing some composite sampling, but it could be a problem because the composite results would need to be adjusted based on the #'s of samples in each composite. We could discuss further if you wish.

Kimberly N. Tisa
U.S. Environmental Protection Agency
5 Post Office Square, Suite 100
Mail Code: OSRR07-2
Boston, MA 02109-3912

Phone: 617.918.1527
E-Fax: 617.918.0527

tisa.kimberly@epa.gov

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  |"Patrick Goddard" <pgoddard@lexingtonma.gov>
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| To:        |
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  |Kimberly Tisa/R1/USEPA/US@EPA
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|06/13/2011 09:11 AM
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|RE: FW: O&M Plan for PCBs, Estabrook School (EH&E 17228)
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Kim,
This is the original layout.
Pat

Patrick W Goddard
Director of Public Facilities
Town of Lexington
201 Bedford Street
Lexington, MA 02420

781-274-8958
pgoddard@lexingtonma.gov

-----Original Message-----
From: Tisa.Kimberly@epamail.epa.gov
[mailto:Tisa.Kimberly@epamail.epa.gov]
Sent: Monday, June 13, 2011 9:03 AM
To: Patrick Goddard
Subject: RE: FW: O&M Plan for PCBs, Estabrook School (EH&E 17228)

Pat-

I'm going to look at what was originally provided. Was the plan not to scale originally? Again, the # of samples have tripled.

Kimberly N. Tisa
U.S. Environmental Protection Agency
5 Post Office Square, Suite 100
Mail Code: OSRR07-2
Boston, MA 02109-3912

Phone: 617.918.1527
E-Fax: 617.918.0527

tisa.kimberly@epa.gov

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|"Patrick Goddard" <pgoddard@lexingtonma.gov>
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|Kimberly Tisa/R1/USEPA/US@EPA
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|06/13/2011 07:55 AM
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|RE: FW: O&M Plan for PCBs, Estabrook School (EH&E 17228)
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Hi Kim,
The original plan developed by the EH&E LSP included 60 samples (including quality control) for the soil testing program. Your direction of sampling every ten feet increased the sample size to 157 samples. I am managing my budget for year end (6/30) so Matt let me know immediately that this exceeded his estimate of $14,700 to complete the plan. They are on site today, and there are some areas that fall at ten feet that can't be sampled, so the actual number will decrease.

Please call if you have other questions. Also, I need your response, please, on the O&M Plan for discussion tomorrow with the Advisory Committee.

Thanks,
Pat

Patrick W Goddard
Director of Public Facilities

Town of Lexington
201 Bedford Street
Lexington, MA 02420

781-274-8958
pgoddard@lexingtonma.gov
-----Original Message-----
From: Tisa.Kimberly@epamail.epa.gov
[mailto:Tisa.Kimberly@epamail.epa.gov]
Sent: Monday, June 13, 2011 7:27 AM
To: Patrick Goddard
Subject: Re: FW: O&M Plan for PCBs, Estabrook School (EH&E 17228)

Pat-

I'm confused on the soil sampling costs....what we spoke about didn't add that many samples to the plan. How did the costs double?

Kimberly N. Tisa
U.S. Environmental Protection Agency
5 Post Office Square, Suite 100
Mail Code: OSRR07-2
Boston, MA 02109-3912

Phone: 617.918.1527
E-Fax: 617.918.0527

tisa.kimberly@epa.gov

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  |"Patrick Goddard" <pgoddard@lexingtonma.gov>
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  |Kimberly Tisa/R1/USEPA/US@EPA
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  |06/09/2011 05:07 PM
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|FW: O&M Plan for PCBs, Estabrook School (EH&E 17228)

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Hi Kim,

I have just received the updated Estabrook Operations and Maintenance Plan that incorporates your suggestions from our conference call last Thursday. In addition, I am sending you the latest surface sampling results, including a location map of where the samples were collected.

EH&E has also update the soil sampling plan to include the additional samples that you requested during the plan review. EH&E will begin sampling tomorrow and they have informed me that the increased sampling has increased the estimated cost of the plan implementation from $14,750 to approximately $30,000.

We have a scheduled Estabrook Advisory Committee meeting on Tuesday the 14th. During the meeting I will review the Estabrook Operations and Maintenance Management Plan. I have attached the workbook that contains the plan and procedures developed to insure compliance with the plan, which I will review with the committee. I will also review with the committee that during our discussion of June 2nd you commented that you will recommend the plan to your management, but we may not receive further communication on the approval process for several weeks or months. Since we are considering relocating the kindergarten classrooms back to their original locations, your support of the O&M plan and the site specific risk assessment is important information to the community in considering this move. Please confirm back to me that you are in agreement with my reporting your support of the O&M plan on Tuesday evening.

Thanks,
Pat

Patrick W Goddard
Director of Public Facilities
Town of Lexington
201 Bedford Street
Lexington, MA 02420

781-274-8958
pgoddard@lexingtonma.gov

From: EH&E Production Department [mailto:ProductionDepartment@eheinc.com
]
Sent: Thursday, June 09, 2011 4:20 PM
To: Patrick Goddard
Cc: Paul Ash; Matt Fragala
Subject: O&M Plan for PCBs, Estabrook School (EH&E 17228)

Mr. Goddard:
On behalf of Matt Fragala, please find the attached Revision One of the Operations and Maintenance Plan for Polychlorinated Biphenyls, Estabrook School, Lexington, Massachusetts (EH&E 17228) in an Adobe Acrobat (.pdf) format.
The document is to follow via the mail.

Environmental Health & Engineering, Inc.
Production Department

1-800-825-5343 (1-800-EHE-TALK)
[attachment "O&M Plan Rev1 (EH&E 17228).pdf" deleted by Kimberly Tisa/R1/USEPA/US] [attachment "Surface Memorandum 060811 (EHE 17228).pdf" deleted by Kimberly Tisa/R1/USEPA/US] [attachment "Estabrook O&M Management Plan.xls" deleted by Kimberly Tisa/R1/USEPA/US]

[attachment "20110613090730490.pdf" deleted by Kimberly Tisa/R1/USEPA/US]

FW: Superintendent's Advisory Committee
Patrick Goddard
to:
Kimberly Tisa
05/23/2011 09:08 AM
Hide Details
From: "Patrick Goddard" <pgoddard@lexingtonma.gov>

To: Kimberly Tisa/R1/USEPA/US@EPA

1 Attachment

Memorandum (EH&E 17228).pdf

HI Kim,

We are continuing to see good results for Estabrook School. Our April air sampling results all came back with under 200ng/m3, which our O&M plan has established as our annual target maximum value. That is now 63 air samples since completion of the mini-walls that have been under 200ng/m3, all with winter ventilation settings.

The school year is drawing to a close and we are preparing plans for the summer and fall. Our Kindergarten classes are all in classrooms that are post 1978 construction and these rooms air concentration results have been under 100ng/m3. We are looking for your feedback on the proposed O&M target maximum value of 200ng/m3, as developed by the site-specific risk assessment. We are considering relocating these classes back to their original rooms over the summer.

I will call you on Thursday afternoon to discuss the status of the plan and how we can move forward. If that doesn't work for you let me know and I can reschedule.

Thanks,

Pat

Patrick W Goddard

Director of Public Facilities

Town of Lexington

201 Bedford Street

Lexington, MA 02420

781-274-8958

pgoddard@lexingtonma.gov

From: Paul B. Ash [mailto:pash@sch.ci.lexington.ma.us]
Sent: Saturday, May 21, 2011 12:00 PM
To: estabrook.advisory@gmail.com; Patrick Goddard; Sandra Trach; Gerard Cody; alessandrini@comcast.net; Katherine O'Hare Gibson; Caroline St. Onge; Heather Kramer; Ellen Silberman
Cc: betsy@philidor.com; Miriam Sousa
Subject: Superintendent's Advisory Committee

Dear Members of the Estabrook Advisory Committee.

I have attached the latest test results. By mid-June, we will receive the final tests for this school year. The June results will show PCB levels when the airflow is set for summer circulation.

I would like to hold one final meeting this year to discuss the May and June PCB reports and our on-going maintenance plan. We hope to have received word from the EPA on the plan.

Given everyone's very busy schedule, are you available on June 13, 14, or 15 at 7 pm? Please email me and let me know when you can meet.

ENVIRONMENTAL HEALTH & ENGINEERING

Environmental Health
& Engineering, Inc.
117 Fourth Avenue
Needham, MA
02494-2725

TEL 800-825-5343
781-247-4300
FAX 781-247-4305

MEMORANDUM

TO: Patrick Goddard, Director of Facilities, Town of Lexington
Paul B. Ash, Ph.D., Superintendent, Lexington Public Schools, Estabrook Advisory Committee

FROM: Matt A. Fragala, M.S., C.I.H., Senior Scientist
Joseph G. Allen, D.Sc., Senior Scientist

DATE: May 19, 2011

RE: Air Samples Collected on April 21 and 22, 2011, Estabrook Elementary School (EH&E 17228)

This memorandum provides results of the most recent air sampling at Estabrook Elementary School (Estabrook). The objective of the air testing was to measure levels of polychlorinated biphenyls (PCBs) in indoor air of classrooms that have been mitigated according to the interim measures and managed according to the Operation and Maintenance (O&M) Plan.

Details of the interim measures and other aspects of the current indoor environmental quality (IEQ) management plan are available in the Project Update memorandum dated October 28, 2010, and the materials distributed to the Superintendent's Advisory Committee on November 4, 2010. In addition, detailed plans on the operation of Estabrook are available in the O&M Plan dated January 29, 2011. In brief, a mini-wall was constructed in each room to encapsulate the lower panels of the curtain wall. The mini-wall separates the panels and associated PCB-containing materials from indoor air of the classroom. I-beam chases were enclosed and specific areas related to the curtain wall were sealed with new caulk or foam insulation. Areas sealed included edges of the mini-wall, metal-to-metal joints of aluminum framing, and original caulking at the intersection of horizontal and vertical aluminum frames. Interim measures were completed in Estabrook by the end of November 2010.

AIR SAMPLE RESULTS

Air samples were collected from approximately 10:00 a.m. – 4:30 p.m. on Wednesday April 20, and Thursday April 21, 2011. Operating conditions for heating and ventilation during the air testing were standard for winter conditions in accordance with the current IEQ management plan included as part of the O&M Plan. The thermostat in each room was set to 70 degrees Fahrenheit.

As shown in Table 1, PCB concentrations in indoor air of the rooms tested ranged from 24 nanograms per cubic meter (ng m^3) to 176 ng m^3. These PCB concentrations are less than the most conservative (i.e., most health protective) annual average target levels for all ages determined by the site-specific assessment (230 ng m^3). In addition, these concentrations are well below the public health levels for annual average concentrations suggested by the U.S. Environmental Protection Agency (EPA) for children older than 6 years (300 ng m^3) and adults (450 ng m^3). In addition, ten out of the fourteen rooms tested were less than the EPA's suggested annual average levels for children less than 6 years old (100 ng m^3).

Table 1 Air Sample Results for Total Polychlorinated Biphenyls, Estabrook Elementary School, 117 Grove Street, Lexington, Massachusetts, July 22, 2010 – April 21 and 22, 2011*

Sample Location	Total PCBs (ng/m³)													
	Round 1[a]	Round 2[b]	Round 3[c]	Round 4[d]	Round 5[e]	Round 6[f]	Round 7[g]	Round 8[h]	Round 9[i]	Round 10[j]	Round 11[k]	Round 12[l]	Round 13[m]	Round 14[n]
Room 1	299	426	118‡	63‡	76‡	153†	145	–	116	–	–	–	146	–
Room 2	–	775	455	189	166	253†	53	–	60	–	–	–	–	136
Room 3	–	–	–	–	–	364†	111	–	110	–	–	–	–	44
Room 4	–	–	–	–	–	344†	126	105	–	–	–	–	–	–
Room 5	459	736	320	196	149	209†	67 – 90	–	128	–	–	–	–	–
Room 6	1,800	764	483	171	213	383†	182	118 – 144	–	–	–	–	97	–
Room 7A	–	–	5.19	–	–	–	–	–	–	–	34	–	–	15
Room 7B	–	–	–	–	–	–	–	–	–	–	<5.3	–	–	57
Room 7C	–	–	–	–	–	–	–	–	–	–	–	–	11-15	–
Room 11	–	–	–	–	–	–	–	–	65	–	–	–	–	–
Room 13	319	340	184	155†	–	–	–	–	89 – 94	–	–	–	94	–
Room 19	–	–	–	–	–	–	–	–	12	–	–	–	–	–
Room 20	–	–	–	–	–	–	–	–	–	57	–	–	–	157-176
Room 21A	–	–	410	193	–	–	–	–	–	–	–	109	103	–
Room 21B	–	–	–	–	–	–	–	–	–	188	–	–	–	–
Room 22	–	–	–	–	–	–	–	–	–	25	–	–	–	–
Room 23	–	–	–	–	–	–	–	–	–	142	–	–	–	68-117
Room 24	680	601	226	173†	–	–	–	–	–	105 – 107	–	–	86	–
Room 25	–	–	–	–	–	–	–	–	–	130	–	–	–	135
Room 26	–	–	–	79	–	–	–	–	–	–	47	–	–	–
Room 27	–	–	–	–	–	–	–	–	–	–	69	–	–	–
Room 31A	562	575	444	–	–	282	–	–	–	94	–	–	–	97
Room 31B	–	–	–	–	–	–	–	–	–	135	–	–	–	52
Room 39B	–	419	–	–	–	–	–	–	–	64	–	–	–	–
Room 39C	342	495	245	100	–	–	–	–	–	125	–	–	76	–
Library	–	469	196	–	–	–	–	–	–	–	135	–	–	–
Art/Music Room	–	–	194	–	–	–	–	–	–	–	–	30	–	61
Teacher Work Room	–	–	138	–	–	–	–	–	–	–	34	–		–
Admin. Offices	–	–	–	–	–	–	–	–	–	–	72	66	–	55-73
Teacher Lounge	–	–	–	–	–	–	–	–	–	89	–	–	–	–
Basement	–	–	227	–	–	–	–	–	–	–	–	–	–	–

Table 1 Continued

Sample Location	Total PCBs (ng/m³) Round 1[a]	Round 2[b]	Round 3[c]	Round 4[d]	Round 5[e]	Round 6[f]	Round 7[g]	Round 8[h]	Round 9[i]	Round 10[j]	Round 11[k]	Round 12[l]	Round 13[m]	Round 14[n]
Ceiling plenum (39C)	–	–	562	–	–	–	–	–	–	–	–	–	–	–
Psychologist Office	–	–	–	–	–	253	–	–	–	–	–	–	–	–
Gym	–	–	–	–	–	–	–	–	–	–	–	38	–	29
Sped Office	–	–	–	–	–	–	–	–	–	–	–	134	–	86
Room B	–	–	–	–	–	–	–	–	–	–	–	148	–	–
Kitchen	–	–	–	–	–	–	–	–	–	–	–	66	–	24
Room D	–	–	–	–	–	–	–	–	–	–	–	108	–	–
Hall Office (Outside Art)	–	–	–	–	–	–	–	–	–	–	–	125	–	–
Outdoors	<3.79	<5.00	<4.20	<4.46	<4.32	<4.44	<5.54	<4.58	<4.60	<4.08	<5.32	<5.95	<4.37	<5.31

PCB polychlorinated biphenyl
ng/m³ nanograms per cubic meter
– air sample not collected at that location

a Round 1 samples collected July 22, 2010, during summer conditions.
b Round 2 samples collected on August 25, 26, or 27, 2010, following removal of caulk around exterior window frame.
c Round 3 samples collected on September 6, 2010, following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted.
d Round 4 samples collected on September 19, 2010, under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted.
e Round 5 samples collected on September 27, 2010, under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
f Round 6 samples collected on September 29, 2010, under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles.
g Round 7 samples collected on October 18 and 19, 2010, under isolation, encapsulation and air cleaner configurations.
h Round 8 samples collected on November 4, 2010, under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
i Round 9 samples collected on November 11, 2010, under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
j Round 10 samples collected on November 20, 2010, under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
k Round 11 samples collected on November 24, 2010, under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
l Round 12 samples collected on December 2, 2010, under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
m Round 13 samples collected on February 23, 2011, under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
n Round 14 samples collected on April 21 and 22, 2011, under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.

* PCB concentration analysis performed by Alpha Analytical Inc., using U.S. Environmental Protection Agency (EPA) Method 10A (GC/MS-SIM).
† Samples collected under minimum outdoor air delivery.
‡ Sample collected with supplemental air outdoor air (1,200 cubic feet per minute).

A graphical summary of the PCB concentration measured in indoor air at Estabrook between July 22 and April 21, 2011, is provided in Figure 1. Indoor air PCB levels measured during Round 14 were significantly lower than in Round 1. Similarly, a 2-fold decrease in average concentrations has been achieved since winter ventilation conditions began in late September. These observations continue to demonstrate the effectiveness of the mitigation methods employed in Estabrook.

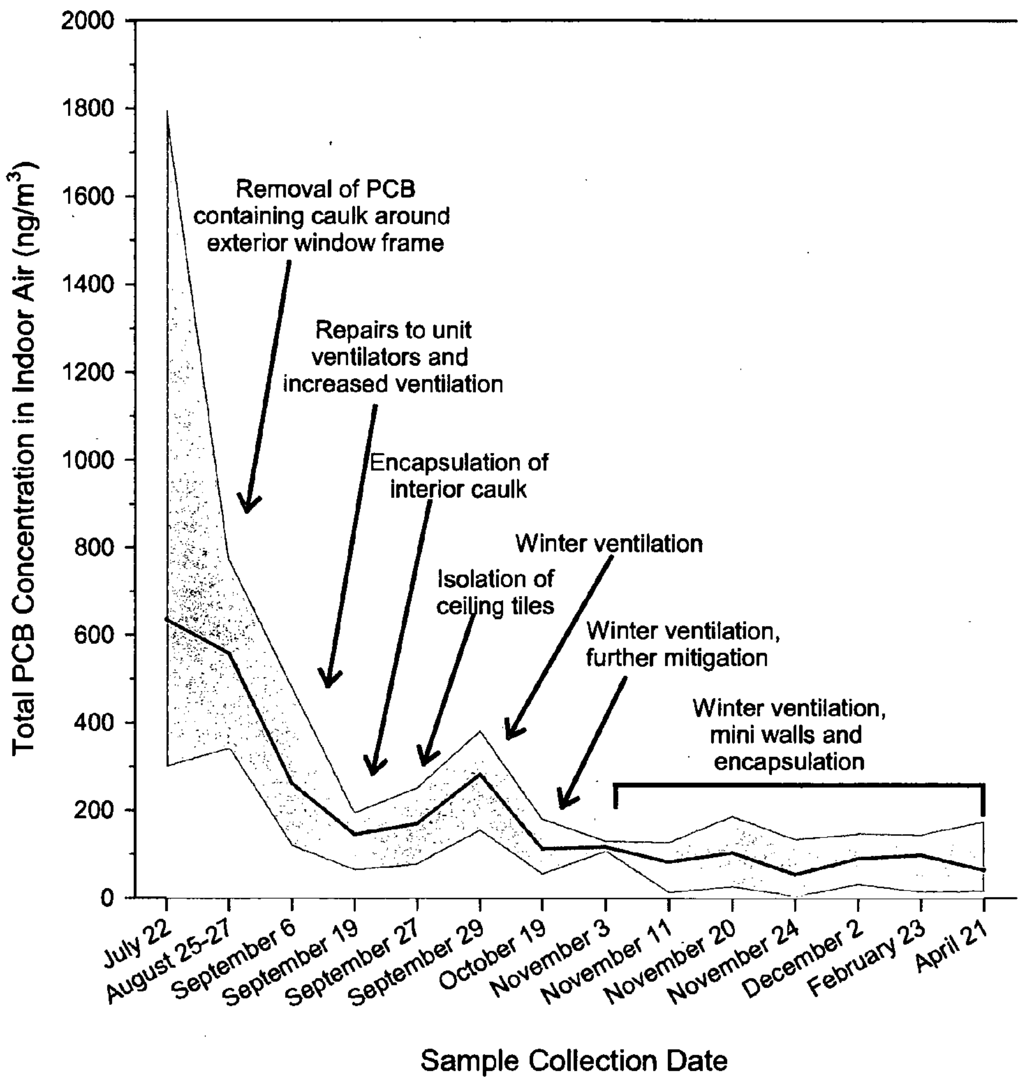

Figure 1 Average (line) and Range (shaded area) of Total PCB Concentration in Indoor Air over Time

If you have any questions regarding this memorandum please do not hesitate to contact us at 1-800-TALK EHE (1-800-825-5343).

LETTER OF TRANSMITTAL

Environmental Health & Engineering, Inc.
117 Fourth Avenue
Needham, MA 02494-2725
PH 781-247-4300 FAX 781-247-4305

To: Ms. Kimberly Tisa
PCB Coordinator
U.S. Environmental Protection Agency
Mail Code: OSRR07-2
Five Post Office Square, Suite 100
Boston, MA 02109-3912

Date: 15 April 2011

Project #: 17228

☒ **Attached** ☐ **Under separate cover, EH&E is sending you the items described below**

No. of Copies	Description
1	Estabrook Elementary School Lexington, Massachusetts Sampling Plan for the Characterization of Soils Potentially Contaminated with Building-Related Polychlorinated Biphenyls

Transmitted via: ☐ Mail/Regular ☐ Mail/Priority ☐ Email ☐ Fax
☐ FedEx O/N a.m. ☐ FedEx O/N p.m. ☐ FedEx 2-Day ☒ Courier
☐ Hand-delivered by: ☐ Other

Transmitted: ☐ For your review and comment ☐ Per your request
☒ For your use ☐ For your reference ☐ Other

Notes:

Copy to:

cw

From: Cylinda Walker

For: **Cynthia Campisano, Matt Fragala**

ESTABROOK ELEMENTARY SCHOOL
LEXINGTON, MASSACHUSETTS

SAMPLING PLAN FOR THE CHARACTERIZATION OF SOILS POTENTIALLY CONTAMINATED WITH BUILDING-RELATED POLYCHLORINATED BIPHENYLS

April 15, 2011

ENVIRONMENTAL
HEALTH & ENGINEERING

ESTABROOK ELEMENTARY SCHOOL
LEXINGTON, MASSACHUSETTS

SAMPLING PLAN FOR THE CHARACTERIZATION OF SOILS POTENTIALLY CONTAMINATED WITH BUILDING-RELATED POLYCHLORINATED BIPHENYLS

Prepared For:

Patrick Goddard
Director of Public Facilities
Town of Lexington
201 Bedford Street
Lexington, MA 02420

Prepared By:

Environmental Health & Engineering, Inc.
117 Fourth Avenue
Needham, MA 02494-2725

EH&E Project #17228

April 15, 2011

P:\17228\Soil Sampling Plan\Soil Sampling Plan.Preliminary Study.docx

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LIST OF ABBREVIATIONS & ACRONYMS

CFR	Code of Federal Regulations
CMR	Code of Massachusetts Regulations
EH&E	Environmental Health & Engineering, Inc.
EPA	U.S. Environmental Protection Agency
HASP	Health and Safety Plan
MADEP	Massachusetts Department of Environmental Protection
MCP	Massachusetts Contingency Plan
PCB	polychlorinated biphenyl
ppm	parts per million
School	Estabrook Elementary School
Site	117 Grove Street in Lexington, Massachusetts
TSCA	Toxic Substances Control Act

1

1.0 INTRODUCTION AND BACKGROUND INFORMATION

1.1 OVERVIEW OF THE SOIL SAMPLING PROGRAM

This document describes the sampling program that will be implemented by Environmental Health & Engineering, Inc. (EH&E) to characterize the soil at the Estabrook Elementary School (the School) located at 117 Grove Street in Lexington, Massachusetts (the Site). Soils may have been impacted by polychlorinated biphenyl (PCB)-containing caulking and sealants in place throughout portions of the School. This soil sampling program is designed to provide a preliminary characterization of potentially PCB-contaminated soils along the perimeter of the School in accordance with methodology outlined by the U.S. Environmental Protection Agency (EPA) in the Toxic Substances Control Act (TSCA) regulations, specifically Title 40 Code of Federal Regulations Section 761 (40 CFR 761).

Based on the results of this preliminary sampling program, additional site characterization and sampling may be warranted to further characterize the nature and extent of potential contamination in advance of soil removal and disposal. As such, this program will also support compliance with the Massachusetts Contingency Plan (MCP) (Title 310 Code of Massachusetts Regulations Section 40 [310 CMR 40]). This soil sampling program will be performed AFTER the completion of the abatement of unauthorized PCBs in exterior caulking materials, which is anticipated to be complete by May 2011.

1.2 EXTERIOR BUILDING MATERIAL ABATEMENT PROGRAM

EH&E performed an investigation to identify suspect PCB-containing caulking and sealants used throughout portions of the School. EH&E collected samples in a manner to investigate the installation and application of caulk/sealant materials, including an evaluation of any evidence indicating window caulk/sealant replacement or repair work.

The analytical results indicated the presence of PCBs in select caulks/sealants associated with the interior and exterior of the School. Concentrations of PCBs in these caulks/sealants are above the allowable concentrations specified by the EPA in the TSCA regulations.

In response to the caulking/sealant sampling results, a detailed and thorough abatement protocol was implemented at the School to address the presence of unauthorized PCBs. The abatement work completed to date involved the removal or encapsulation of the PCB caulks/sealants associated with windows throughout the interior/exterior of the School, including source removal of approximately 550 linear feet of white PCB caulk around exterior windows. Work also included the cleaning of porous and non-porous materials that are in contact with the PCB caulking prior to applying an encapsulant that was used to seal the residual PCBs within the porous substrates. Additional exterior abatement is planned for spring 2011. This abatement work on the building is anticipated to be completed by May 2011.

1.3 PREVIOUS SOIL SAMPLING RESULTS

A very limited surficial soil sampling effort was conducted by EH&E on August 11, 2010. This program included collection of four samples (plus a duplicate) around the section of the School containing Classrooms 1 – 6. Soils from three of the four locations detected PCB concentrations ranging from 0.12 – 0.14 parts per million (ppm).

One sample collected outside Classroom 6 had a PCB concentration of 7.4 ppm. This concentration constitutes a reportable release under the MCP. Because this is a historic release of PCBs and does not pose an Imminent Hazard as defined by the MCP, notification was required within a maximum of 120 days. EH&E on behalf of the Town of Lexington notified Massachusetts Department of Environmental Protection (MADEP) of the release to soils on September 28, 2011, and MADEP assigned a Release Tracking Number (3-29547) to the Site.

Results of the sampling program described in this plan will be used to perform a more detailed Imminent Hazard Assessment. The soil sampling program, detailed in the following sections will focus on characterizing the surficial soils with respect to potential PCB-contamination by collecting representative samples in close proximity to the former locations of PCB-containing caulk lines around the perimeter of the School. In addition, a targeted sampling program will be performed to better characterize the nature and extent of potentially PCB-contaminated soils outside Classroom 6, which may represent a hot spot as defined by the MCP.

2.0 SURFICIAL SOIL SAMPLING PROGRAM

Soils along the perimeter of the School will be sampled for analysis of PCBs. The sampling program will generally focus on shallow soils (0 to 3 inches below grade). Samples will also be collected at depths of 3" to 9" below grade in landscaped and garden areas. In addition, targeted samples will be collected outside Classroom 6.

2.1 SAMPLE LOCATION SELECTION

Caulking with regulated concentrations of PCBs is associated with windows at the building, and in particular it is found between the window units and adjacent brick wall structure. Caulking around the panels below the windows is also presumed to contain regulated concentrations of PCBs. There are 44 typical window units and several more large windows in the patio area with regulated concentrations of caulking at the Estabrook School. Therefore, an aggressive sampling program that includes discrete samples below the caulk lines at a minimum of 50% of the window units will be implemented. The total number of proposed locations, including typical and garden areas is 25 (see Figure in Appendix A).

Typical locations will represent potential worst case conditions, and will be collected adjacent to the building below the caulk line at a depth of 0-3". Therefore a total 19 discrete samples will be collected at these locations. This program includes previously collected samples where appropriate (two previous locations and 17 new locations).

In addition, in garden and landscaped areas an additional six locations will be tested. Soils in these areas are presumed to be mixed at greater depths due to maintenance activities. Therefore, composite samples will be collected from a minimum of three locations within each sample area. Two composites samples from each area will be analyzed; one from 0-3" depth and one from 3-9" depth.

In addition, samples will be collected from 3 locations surrounding the sample collected outside Classroom 6. Discrete samples will be collected from 0-3" and 3-6" at each location. A sample will also be collected from 3-6" at the original Classroom 6 location.
The approximate locations where sampling will be performed are illustrated in Appendix A. Based on the selection criteria previously described, shallow soils will be sampled in

2

- At mixed soil locations (landscaped and garden areas) each soil sample will be collected by compositing soil from three locations within the selected sample area. Each final sample will be collected for analysis by homogenizing the soil collected from each of the three composites. Therefore, it is anticipated that two samples will be collected from disturbed soil area as follows (assuming there are no stratum changes over the depth of 0 to 9 inches):

  - Sample 1: Soil from 0-3" below ground at three locations.
  - Sample 2: Soil from 3-9" below ground at three locations.

- A minimum of 50 grams of soil will be collected for each sample. All samples will be collected into pre-cleaned amber jars provided by the analytical laboratory and stored in a cooler with ice and maintained at 4 degrees Celsius until transfer to the laboratory.

- All sample collection activities will be documented using standard EH&E field documentation methodology, including using appropriate field datasheets and assigning samples unique identification numbers. All samples shall be maintained under chain of custody.

- For quality control purposes, a minimum of one duplicate sample will be collected for every ten soil samples collected. The duplicates will be collected for both depths at each duplicate location.

- In addition a minimum of one matrix spike and matrix spike duplicate sample will be collected and analyzed for every ten primary samples obtained.

- The laboratory will provide a quality assurance/quality control report compliant with the MADEP MCP Compendium of Analytical Methods to ensure data usability requirements are met.

2.3 DECONTAMINATION PROCEDURES

- Sampling equipment shall be decontaminated between use at each sample location. Methods used will be (in the following order) a Liquinox and distilled water scrub, a distilled water rinse, and air drying. Sampling devices shall be visually assessed for evidence of potential cross-contamination following cleaning and before each use.
- Decontamination fluids will be collected and containerized to allow proper disposal. A sample of the containerized fluids will be collected at the conclusion of the program for analysis of PCBs.
- All non-fluid waste generated during the sampling program, such as disposable gloves, will also be collected and containerized to allow proper disposal.
- The containerized decontamination fluids and gloves shall be appropriately labeled and temporarily stored in an inaccessible, secure location at the Site until characterization and disposal is complete.

2.4 SAMPLE ANALYSIS

- Once the samples are collected, they shall be transported under chain of custody to a qualified laboratory for analysis. The soil samples have a holding time of 14 days prior to laboratory extraction and a holding time of 40 days after extraction.
- Samples will be analyzed via EPA Method 8082 (with soxlet extraction), and in accordance with MADEP/MCP data usability requirements. The laboratory will provide data certification in compliance with the MADEP Compendium of Analytical Methods.

2.5 FIELD HEALTH AND SAFETY REQUIREMENTS

All field activities conducted by EH&E shall be in accordance with EH&E's site-specific Health and Safety Plan (HASP) in place for the Project and in conformance with the EH&E Health and Safety Program.

In addition to meeting all of the specific requirements outlined in the HASP, a Dig Safe® review must be arranged and completed prior to the initiation of soil sampling. Although the Dig Safe review will have been completed, EH&E field personnel are also responsible for taking extreme care during below-grade soil sampling; soil collection shall stop immediately at any location if it is suspected that underground utilities or any non-soil associated material or systems may be present or are encountered.

2.6 SCHEDULE

EH&E anticipates completion of the field program in two days using a team of two investigators.

A

APPENDIX A

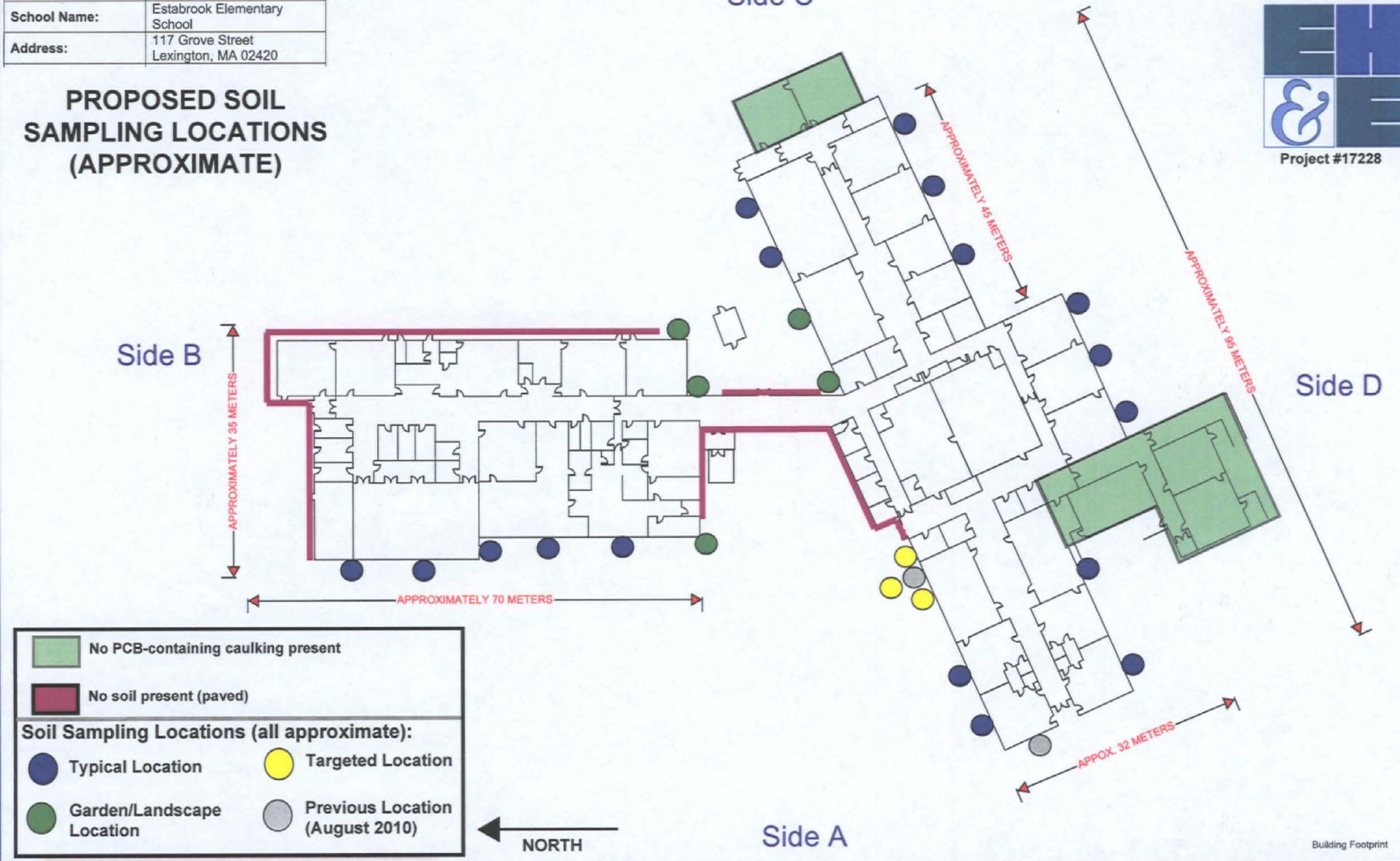
APPROXIMATE SAMPLE LOCATIONS

District:	Lexington
School Name:	Estabrook Elementary School
Address:	117 Grove Street Lexington, MA 02420

Environmental Health & Engineering

Project #17228

PROPOSED SOIL SAMPLING LOCATIONS (APPROXIMATE)



B

APPENDIX B

FIELD SUPPLY LIST

FIELD SUPPLY LIST

The following list can be supplemented or modified depending on field conditions.

DOCUMENTATION

- Pens, sharpies
- Digital camera (1 per person with adequate batteries and memory cards)
- Field notebooks
- Site/building plans
- EH&E soil sampling datasheets
- Soil boring logs
- Unique sample IDs
- Chain of custody forms

SAMPLE COLLECTION

- Disposable gloves—nitrile
- Trowels (2)
- Shovel
- Post-hole digger
- Measuring tape (~25 feet)
- Measuring tape (longer spool-type)
- Stainless steel bowls
- Pre-cleaned soil sample collection jars (provided by laboratory)
- Pre-cleaned water sample collection jars (provided by laboratory)

SAMPLE PRESERVATION

- Coolers (adequate number for sample jars)
- Ice packs (adequate number to keep samples cool to 4 degrees Celsius)

DECONTAMINATION/CLEAN-UP

- Spray bottles (minimum of 1 for 100% deionzed water)
- Spray bottles (minimum of 1 for liquinox and deionized water solution)
- Plastic sheeting
- Extra Liquinox concentrate
- Extra deionized water
- Paper towels
- Contractor trash bags
- Five gallon buckets with watertight lids (approximately 3)

MISCELLANEOUS SUPPLIES

- Cart and/or plastic boxes/crates for on-site equipment/coolers
- Sealable plastic bags—gallon size

From: EH&E Production Department
Sent: Monday, February 28, 2011 7:22 PM
To: 'Tisa.Kimberly@epa.gov'
Cc: 'pgoddard@lexingtonma.gov'; 'pash@sch.ci.lexington.ma.us'; Matt Fragala; Joseph Allen; David MacIntosh
Subject: Final Site-Specific Assessment and O&M Plan for PCBs, Estabrook School, Lexington (EH&E 17228) Letter dated February 28
Attachments: EPA Letter and Attachments 022811 (EH&E 17228).pdf

Ms. Tisa:

On behalf of Matt Fragala and Joseph Allen, please find the attached **amended** EH&E cover letter with attachments:

Letter from Town of Lexington,

Massachusetts School Building Authority announcement,

Final Site-Specific Assessment for Polychlorinated Biphenyls for Estabrook School, Lexington, Massachusetts, and the

Operation and Maintenance Plan for Polychlorinated Biphenyls for the Estabrook School (EH&E 17228) in Adobe Acrobat (pdf) format.

The cover letter is updated to include the MSBA announcement.

Please disregard the email sent on February 26.

These documents are to be delivered to you on Tuesday, March 1.

Environmental Health & Engineering, Inc.
Production Department
1-800-825-5343 (1-800-EHE-TALK)

ENVIRONMENTAL HEALTH & ENGINEERING

Environmental Health
& Engineering, Inc.

117 Fourth Avenue
Needham, MA
02494-2725

TEL 800-825-5343
781-247-4300
FAX 781-247-4305

www.eheinc.com

February 28, 2011

Ms. Kimberly Tisa
PCB Coordinator
U. S. Environmental Protection Agency
Mail Code: OSRR07-2
Five Post Office Square, Suite 100
Boston, MA 02109-3912

RE: Estabrook Elementary School, Lexington, Massachusetts (EH&E 17228)

Dear Ms. Tisa:

This letter is intended to provide the U.S. Environmental Protection Agency (EPA) information regarding the plan for operations and maintenance of the Estabrook Elementary School located at 117 Grove Street in Lexington, Massachusetts (the School). As previously reported to your office, polychlorinated biphenyl (PCB)-contaminated materials that exceed the allowable levels under the federal PCB regulations have been identified at the School and actions have been undertaken by Lexington to address risks associated with the identified material.

On behalf of the Town of Lexington we are requesting EPA approval of the Operations and Maintenance Plan provided as an attachment to this letter. The Lexington Department of Public Facilities has indicated that the Town of Lexington plans to decommission and replace the Estabrook Elementary School. Currently, the plan in place estimates occupancy of the new School for fall 2014. Please see the letter provided (Attachment A) by the Town of Lexington that describes the process and timeline currently in place for the occupancy of a new school. On February 10, 2011, the Massachusetts School Building Authority announced that Estabrook Elementary will enter the feasibility study phase. This announcement is included as Attachment B and is an important stage in the process of building a new school for the Estabrook community.

This submittal contains two additional components as attachments:

SITE-SPECIFIC ASSESSMENT

Attachment C is a copy of the Site-Specific Assessment developed for the School. This plan was originally submitted to EPA on October 20, 2010, has been revised based comments provided by EPA in their November 30, 2010, letter. The Site-Specific Assessment has been reviewed by the Estabrook Advisory Committee as well as by representatives of Lexington Public Schools and Lexington Public Facilities. Information from this plan has been used to create the Operations and Maintenance Plan that is included as Attachment D.

OPERATIONS AND MAINTENANCE PLAN

This plan describes operations and maintenance procedures for the continued management and control of PCBs at the School. The plan contains specific responsibilities, sampling requirements, maintenance practices, and ventilation requirements designed to manage potential health risks of PCBs at the School. The intent of the plan is to:

- Recognize, control, and mitigate potential PCB hazards at Estabrook.
- Ensure the continued health and safety of students, staff, visitors, contractors, vendors, and the community.
- Maintain compliance with occupational and environmental regulations pertaining to PCBs.
- Implement proactive maintenance activity reviews to identify work with the potential to disturb PCB-containing materials.
- Maintain air and surface concentrations of PCBs below established health based guidelines.
- Ensure adequate ventilation is provided to Estabrook.
- Specify environmental sampling schedules and plans.

Once approved by EPA, the Operations and Maintenance Plan and Site-Specific Assessment will be issued as part of the Final Completion Report for this project.

If you have any questions, please feel free to contact either of us at 1-800-TALK EHE (1-800-825-5343).

Sincerely,

Matt A. Fragala, M.S., C.I.H. Senior Scientist	Joseph G. Allen, D.Sc., M.P.H. Senior Scientist

Attachment A	Town of Lexington Letter
Attachment B	MSBA Approval Announcement
Attachment C	Site-Specific Assessment
Attachment D	Operations and Maintenance Plan

cc: Patrick Goddard, Director of Facilities, Town of Lexington
Dr. Paul Ash, Superintendent, Lexington Public Schools

ATTACHMENT A

TOWN OF LEXINGTON

Department of Public Facilities

Patrick W. Goddard
Director of Public Facilities

Tel: (781) 274-8958
Email:pgoddard@lexingtonma.gov

January 19, 2011

Kimberly N. Tisa
U.S. Environmental Protection Agency
5 Post Office Square, Suite 100
Mail Code: OSRR07-2
Boston, MA 02109-3912

Ms. Tisa,

Air sampling in all educational spaces at Estabrook School indicates that the polychlorinated biphenyl (PBC) concentrations are currently being managed to a level below 200ng/m3. The proposed Estabrook School Operation and Maintenance plan outlines the process and procedures that will be implemented to maintain the existing levels until a new school is constructed.

The Lexington Superintendent of Schools, Dr. Paul Ash, filed an Emergency Statement of Interest (SOI) with the Massachusetts School Building Authority (MSBA) on Friday November 5, 2010. The SOI explained the PBC contamination at Estabrook School and the need to prioritize the replacement of the school. The Lexington School Committee recently voted to make replacement of the Estabrook School as the number one priority for the district for funding support from the MSBA.

On January 19th, a Senior Study was conducted at Estabrook School by MSBA and their consultants with Superintendent Ash, Principal Sandra Trach, and me. The purpose of the Senior Study is to review the current condition of the school and confirm the need expressed in the Emergency SOI. A report will be developed from the Senior Study for review at future MSBA Board meetings. MSBA will notify Superintendent Ash as soon as a decision is made by MSBA on the decision to support the school replacement.

It is expected that the new Estabrook School will cost in the range of $30,000,000. Such expenditure will require support by Town Committees, Town Meeting and a debt exclusion vote of the Town registered voters. We expect that the earliest we can complete the process to gain voter support for the funding, design the new school, and construct the new school and open it for students would be for the fall 2014 school year. There is a possibility that the process could be delayed, and should that happen we will send you an updated schedule.

Let me know if you have any questions.

Pat Goddard

ATTACHMENT B

Massachusetts School Building Authority

Funding Affordable, Sustainable and Efficient Schools for Local Communities

Estabrook Elementary in Lexington Will Enter Feasibility Study Phase

February 10, 2011

The Massachusetts School Building Authority Announces That Estabrook Elementary Will Enter Feasibility Study Phase

Lexington invited into the MSBA's Capital Pipeline

BOSTON, MA – State Treasurer Steven Grossman, Chairman of the Massachusetts School Building Authority ("MSBA") and Katherine Craven, MSBA Executive Director, announced today that the MSBA Board voted to move Estabrook Elementary School into the MSBA's Capital Pipeline for potential funding. The project will move into the Feasibility Study phase where Lexington and the MSBA will work in collaboration to study potential solutions to the problems identified in the district's Statement of Interest.

"I am pleased to welcome Estabrook Elementary into the MSBA's Capital Pipeline. We are committed to working with Lexington to find the most economical solution to the problems at Estabrook so that the children of Lexington can grow and learn in an educationally appropriate and safe facility," said State Treasurer Steven Grossman.

"The MSBA remains committed to working with Lexington to better understand the issues at Estabrook Elementary," stated Katherine Craven, MSBA Executive Director. "We look forward to continuing our due diligence to determine what the best plan of action is moving forward."

"I'm very pleased that MSBA is partnering with Lexington to address the problems identified at the Estabrook School. I'm confident that together they will develop a successful plan of action," said Sen. Ken Donnelly.

"I am very pleased and impressed that the MSBA is moving this project into the feasibility category. I look forward to working with school and community leaders and with the MSBA to determine the best solution to the serious deficiencies at Estabrook," said Representative Jay Kaufman.

The MSBA strives to find the right-sized, most fiscally responsible and educationally appropriate solutions to create safe and sound learning environments. The MSBA is committed to protecting the taxpayer's dollar by improving the school building grant process and avoiding the mistakes of the past in the funding and construction of schools. The MSBA reformed the Commonwealth's formerly rampant and unsustainable program, which was more than \$11 billion in debt. The MSBA has made \$7.4 billion in reimbursements to cities, towns and regional school districts for school construction projects. These timely payments have saved municipalities over \$2.9 billion in avoided local interest costs and have provided much needed cash flow to communities.

ATTACHMENT C

SITE-SPECIFIC ASSESSMENT FOR POLYCHLORINATED BIPHENYLS ESTABROOK SCHOOL LEXINGTON, MASSACHUSETTS

Prepared For:

Mr. Patrick Goddard, Director of Facilities,
Dr. Paul Ash, Superintendent, Lexington Public Schools
Town of Lexington
201 Bedford Street
Lexington, MA 02420

Prepared By:

Environmental Health & Engineering, Inc.
117 Fourth Avenue
Needham, MA 02494-2725

EH&E Report #17228

February 26, 2011

P:\17228\Report\Final Site-Specific Assessment.doc

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LIST OF ABBREVIATIONS AND ACRONYMS

ATSDR	Agency for Toxic Substances and Disease Registry
BW	body weight
Committee	Estabrook Advisory Committee
EH&E	Environmental Health & Engineering, Inc.
EPA	U.S. Environmental Protection Agency
FDA	U.S. Food and Drug Administration
IR	inhalation rate
kg	kilograms
LPS	Lexington Public Schools
PCB	polychlorinated biphenyl
RfD	reference dose
School	Estabrook Elementary School
TDS	Total Diet Study
Town	representatives of Lexington Public Schools and Lexington Public Facilities
ng/kg-day	nanograms of PCBs per kilogram body weight per day
ng/m^3	nanograms per cubic meter
°F	degrees Fahrenheit

1.0 INTRODUCTION

This report describes the site-specific risk assessment for polychlorinated biphenyls (PCBs) at Estabrook Elementary School (the School), Lexington, Massachusetts, prepared by Environmental Health & Engineering, Inc. (EH&E) for the Town of Lexington. Preliminary versions of the site-specific risk assessment have been reviewed by the Estabrook Advisory Committee (the Committee) as well as by representatives of Lexington Public Schools (LPS) and Lexington Public Facilities (the Town). This report reflects assessment questions and exposure scenarios developed with input from the Committee and Town, including decisions made during the Committee meetings on October 6, 2010, and October 12, 2010. The site-specific risk assessment will be updated if any additional information becomes available on background or school-related exposure conditions.

1.1 OBJECTIVE

The objective of the site-specific risk assessment is to develop information intended to help understand and manage potential health risks of PCBs in the indoor air of the School. The risk assessment is used to identify targets for concentrations of PCBs in the indoor air of the School. The targets are intended to be protective of health and to reflect exposure concentrations and time-location patterns that are representative of students, teachers, and staff at the School. As with any health risk assessment, the results of the site-specific assessment do not define "unsafe" levels of exposure, but instead establish exposures that are unlikely to present an appreciable likelihood of adverse effect.

1.2 BACKGROUND

Human health risk assessment is a process for estimating the likelihood of an adverse effect on an organism or population following exposure to a particular agent (WHO 2004). Risk assessment takes into account the inherent characteristics of the agent of concern as well as the characteristics of the specific population of interest. In general terms, assessment of human health risk requires identification, compilation, and integration of information on (i) health hazards of a chemical, (ii) human exposure to the chemical, (iii) and relationships among exposure, dose and adverse effects (WHO

2004). Identification of uncertainties is an important component of human health risk assessments. The results of a risk assessment are useful for identifying options to manage risk and also for communicating with interested audiences.

2.0 METHODOLOGY

The approach to the site-specific risk assessment for the School follows the methods in a tool developed by the U.S. Environmental Protection Agency (EPA) for evaluating concentrations of PCBs in indoor air of schools (EPA 2009). EPA applied the tool to background exposure and activity patterns in a school reported to be representative of a typical school population in the United States. In the site-specific assessment, EH&E relied upon information about exposure concentrations and time spent in various parts of the School that are specific to the School community. The EPA and site-specific exposure estimation tools are described further in Sections 2.1 and 2.2.

2.1 EPA EXPOSURE ESTIMATION TOOL

EPA developed a PCB Exposure Estimation Tool (an electronic spreadsheet) in which total exposure to PCBs from a variety of sources is compared to the reference dose (RfD) for a specific commercial mixture of PCBs known as Aroclor 1254. EPA defines the RfD as, "An estimate of a daily oral exposure for a given duration to the human population (including susceptible subgroups) that is likely to be without an appreciable risk of adverse effects over a lifetime." Both exposure and the RfD are expressed in units of nanograms of PCBs per kilogram body weight per day (ng/kg-day). Details of the EPA methodology and input parameters are available elsewhere (EPA 2009).

PCB exposure from background levels in the environment and indoor air of the School are both considered in the spreadsheet. Background exposure is derived from measured levels of PCBs in food, air, soil, and dust reported in scientific literature and assumptions about age-specific rates of food consumption, inhalation, incidental ingestion, and skin contact with soil and dust. The difference between the RfD for Aroclor 1254 and background exposure is used to calculate PCB exposure at a school that would limit the total exposure rate to a level below the RfD. The concentration of PCBs in indoor air of a school equivalent to that exposure is then calculated from the amount of time in the school and standard age-specific inhalation rates. The analysis is done for a typical individual in each of several age groups.

2.2 SITE-SPECIFIC ASSESSMENT

2.2.1 Overview

EH&E built upon the EPA Exposure Estimation Tool to develop an assessment of school-related PCB exposure that is based upon time-location and ventilation conditions specific to the School. As described below, both time-location patterns and ventilation conditions in the School vary by time of year. Therefore, a temporally-resolved analysis is required to simulate potential exposure to PCBs in indoor air.

The site-specific assessment is based on the day-by-day academic calendar published by LPS. The LPS calendar indicates start and end dates of a school year, distinguishes full days from partial days, and identifies school days and holidays over the course of a calendar year.

The site-specific assessment has a seasonal component as well. The seasonal component reflects the two ventilation strategies available to the School. During temperate seasons when heating is not required inside the School, ventilation rates can be maintained that yield air exchange rates in the range of 2 to 8 per hour. In the remainder of the year, the ventilation system is set to attain air exchange rates of 1 to 4 per hour (approximately half of the previous rates).

By incorporating daily time-location patterns and seasonal heating conditions, the site-specific assessment provides a more accurate simulation of potential exposures than the generic assessment for schools available from EPA. Details of inputs to the site-specific assessment are provided in the remainder of Section 2.2.

2.2.2 Background Exposure

The site-specific assessment relies upon background concentrations of PCBs that were measured at the School, derived from studies of background PCB exposure or replicated from the EPA Exposure Estimation Tool. Details of the background concentrations of PCBs for the site-specific assessment, including comparisons to the corresponding values used in the EPA assessment for a generic school are described in the following sections. Table 2.1 shows the measured on-site concentrations of PCBs in the School and in the background as well as the EPA default values.

Table 2.1 Measured On-site Concentrations of PCBs and Associated EPA Default Values

Location	Unit	EPA Default Values	Estabrook School Specific Values
School Concentration			
C_{air}-outdoor	ng/m^3	0.5	0.6
Background Concentration			
C_{air}-indoor	ng/m^3	6.9	10
C_{air}-outdoor	ng/m^3	0.5	0.6
C_{dust}	µg/m^3	0.22	0.69
C_{soil}	µg/m^3	0.05	0.06

EPA U.S. Environmental Protection Agency
C concentration
ng/m^3 nanograms per cubic meter
µg/g micrograms per gram

2.2.2.1 Dietary Exposure

Background rates of exposure to PCBs in food were based on results of a national market basket study of substances in food conducted by the U.S. Food and Drug Administration (FDA) and known as the Total Diet Study (TDS). The site-specific assessment drew upon the most recent (2003) data available from the TDS (FDA 2010). The food types, PCB concentration, and consumption amounts reported by FDA for 2003 are shown in Table 2.2. The average PCB concentration for each food type was calculated across the 4 quarters of sampling during 2003. Non-detect samples were treated as zero. Food consumption rates for the 3 to <6 year age group were based upon the average food-specific consumption rates for 2 and 6 year old children as reported for the TDS. A body weight of 18.6 kilograms (kg) was used for children less than 6 years old.

Table 2.2 PCB Concentrations and Food Consumption Rates for 2-Year and 6-Year Old Children, U.S. Food and Drug Administration Total Diet Study, 1997 and 2003

Food Type Containing PCBs	PCB Concentration (ppm) First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Food Consumption Rate (g day^{-1})
1997					
Eggs, fried with added fat	ND	ND	0.01 T	ND	6.98 [5.46]
Raisins, dried	ND	ND	0.01 T	ND	1.39 [0.65]
2003					
Salmon, steaks/fillets, baked	0.038	0.016	0.022	0.045	0.84 [1.29]
Catfish, pan-cooked w/ oil	ND	0.017	ND	ND	0.71 [0.98]

PCB polychlorinated biphenyl
ppm parts per million
g day^{-1} grams per day
ND not detected
T Trace; greater than or equal to the limit of detection but less than the limit of quantification.
[ ] consumption for 6 year old

Background dietary exposure to PCBs in the EPA Exposure Estimation Tool is also based upon the FDA TDS. However, dietary exposure in the EPA assessment is based upon results of the 1997 TDS as listed in Tables 6-24 and 6-25 of the Toxicological Profile for PCBs published by the Agency for Toxic Substances and Disease Registry (ATSDR 2000). Based upon TDS data available from FDA (FDA 2010), PCBs were detected in one of four samples of each of two food types sampled in the 1997 TDS (see Table 2.2). The concentrations were reported as 'trace', which for the TDS is defined as result greater than the limit of detection but less than the limit of quantitation (MacIntosh et al. 1996). The other three samples from that year for both foods were presumably below the limit of detection.

Table 2.3 Summary of Average Daily Background Dietary Exposure to PCBs in the Site-Specific Assessment and EPA's Assessment for a Generic School

Parameter	Site-Specific (ng/kg-day)[1]	EPA Generic Assessment (ng/kg-day)[2]
3 to <6 years	1.9	8
6 to <12 years	1.2	3
Staff	1.7	2

PCB polychlorinated biphenyl
EPA U.S. Environmental Protection Agency
ng/kg-day nanograms of PCBs per kilogram body weight per day
FDA U.S. Food and Drug Administration

1 U.S. Food and Drug Administration (FDA) Total Diet Study, 2003
2 FDA Total Diet Study, 1997

Background rates of exposure to PCBs through diet for the site-specific assessment conducted by EH&E and the generic school assessment conducted by EPA are shown in Table 2.3. Because of differences in PCB levels measured in the 1997 and 2003 TDS, site-specific dietary background exposures were lower than those used in the EPA assessment. Interestingly, however, EH&E was not able to reproduce the dietary exposure rate of 8 ng/kg-day reported in the EPA Exposure Estimation Tool for the 3 to <6 year age group. The highest background rate of exposure that could be attained directly from the 1997 TDS data was 6.5 ng/kg-day based upon the trace levels of PCBs reported for foods in the 1997 market basket study and corresponding food consumption rates and body weight of 12.9 kg for a 2-year old (EPA 2008). This unexplained difference represents a source of uncertainty in the assessment.

Use of the 2003 dietary exposure data, rather than the 1997 data, makes the site-specific assessment more current than the EPA assessment. To account for what may be a difference in methods of using the TDS data between EH&E (our method found in section 2.2.2.1.1) and EPA, a sensitivity analysis was conducted in which background dietary exposure derived from the 2003 TDS for the site-specific assessment was increased by 20%. Details are provided in section 4.2.

2.2.2.1.1 Calculation of Dietary Exposure

Using the 2003 dietary exposure data, we found that the only two detectable sources of PCBs were catfish and salmon. To minimize the amount of regional bias, we averaged the concentration values (assuming a value of 0 when the concentration level was below the limit of detection). Then multiplying by consumption per age group and dividing by average weight per age group, we found the dietary exposure per age group of PCBs.

2.2.2.2 Non-Dietary Background Exposure

Non-dietary background rates of exposure in the site-specific assessment were identical to the values used by EPA in its generic assessment. However, to evaluate the sensitivity of the results to choices about inputs to the assessment, concentrations of PCBs in background indoor air, soil, and dust reported for homes in New Bedford, Massachusetts, were also used to estimate target levels for PCBs in indoor air of the

School. The New Bedford background concentrations (Table 2.4) are greater than the values relied upon by EPA and may reflect the extensive and well documented history of PCB contamination in that community, even when using the data from homes not considered to be impacted ("control homes") in those studies (EPA 2010).

Table 2.4 Indoor and Outdoor Air PCB Concentrations (ng/m^3) in New Bedford Harbor Neighborhoods and Comparison Neighborhoods in Dartmouth and Downtown New Bedford[1]

Type of Neighborhood	Type of Air	Mean	Standard Deviation	Minimum	Maximum
New Bedford Harbor Area	Indoor (n=18)	18	1.8	7.9	61
	Outdoor (n=20)	4.9	4.6	0.4	53
Reference Areas in Dartmouth and Downtown New Bedford	Indoor (n=16)	10	1.8	5.2	51
	Outdoor (n=20)	0.6	3.3	0.1	8.2

PCB polychlorinated biphenyl
ng/m^3 nanograms per cubic meters

[1] Vorhees D, Cullen AC, and Altshul LM. 1997. Exposure to Polychlorinated Biphenyls in Residential Indoor Air and Outdoor Air near a Superfund Site. *Environmental Science & Technology*, 31:3612-3618.

Use of the New Bedford data for background concentrations makes results of the sensitivity analysis more conservative, (i.e., unlikely to underestimate actual background exposure), than the EPA generic assessment or the site-specific assessment.

2.2.3 Time in School

The site-specific assessment also relies upon information about time spent inside and outside of the School. Site-specific time-location data were obtained from the Principal and teachers. Details of the site-specific inputs are described in this section and compared to the values used by EPA in its assessment for a generic school.

As shown in Table 2.5, children and staff were reported to spend more days per year and more hours per full day of school in the School in comparison to the generic time-location information relied upon by EPA. However, the academic calendar for the School includes 141 full days of school (7 hours per day) and 41 partial days of school (about 4 hours per day) on the remaining school days. As a result, total time in the

School for students is 1,151 hours, approximately 2% less than the 1,180 hours used in the generic assessment conducted by EPA. Though more accurate than the EPA generic assessment, this value does not significantly affect the results.

Table 2.5 Time-Location Inputs to the EH&E Site-Specific and EPA Generic Assessments

Parameter	Unit	3 to <6 yr	6 to <12 yr	Staff	Basis
EPA Generic Assessment					
School days	days/year	180	180	185	EPA Exposure Estimation Tool. (EPA 2009)
School hours	hour/day	6.5	6.5	8	
Indoors at School	hour/day	6	6	8	
Specialty classroom hours	hour/day	NA	NA	NA	
Outdoors at School	hour/day	0.5	0.5	0	
Site-Specific Assessment					
School days	days/year	182	182	184	Based on information obtained from Principal and teachers, Estabrook School
School hours	hour/day	7	7	8.5	
Indoors at School	hour/day	6.5	6.5	8.5	
Specialty classroom hours	hour/day	1.2	1.1	0	
Outdoors at School	hour/day	0.5	0.5	0	

EH&E Environmental Health & Engineering, Inc.
EPA U.S. Environmental Protection Agency
NA not applicable

The site-specific assessment also reflects time-location patterns within the School. This is important because measurements of PCB concentrations in indoor air of the School show that concentrations in interior rooms and rooms with the highest ventilation rates are lower than corresponding levels in rooms around the building perimeter. Air samples collected on September 6, 2010, indicate that the median PCB concentration in homeroom classes was approximately twice the median level measured simultaneously in specialty rooms (art room, library and teacher's work room). This relationship in concentration between homerooms and specialty class rooms was carried throughout the site-specific assessment. Differences of concentrations between perimeter and interior rooms are attributable primarily to PCB-containing caulk on the curtain wall in each of the perimeter rooms, but also variability of ventilation rates among rooms.

Art, music, and library classes in addition to wellness activities (nurse, etc.) are held in either interior rooms or rooms with ventilation rates among the highest measured in the

School. Homerooms are located along the building perimeter. Information on time spent in specialty classes was obtained from educational staff of the School and is summarized in the following sections. Accounting for actual time in the building makes the site-specific assessment more accurate for the School than the generic assessment prepared by EPA.

2.2.3.1 Students

Children were reported to be at school from 8:15 a.m. through 3:15 p.m. Every Thursday and 5 additional days were reported to be partial days where children are dismissed at 12:15 p.m. Outdoor recess was reported to account for 0.5 hour per day on full school days and 0.25 hour per day during partial school days, except for days with daytime high temperatures below 30 degrees Fahrenheit (°F). In those cases, children were assumed to have recess inside the gym, thereby increasing time indoors during the heating season. Meteorological records from Logan International Airport for the winter of 2009 – 2010 indicate there were 21 days with daytime highs less than 30 °F.

Information on time-location patterns in the School, Table 2.6, also showed that students spend time in specialty class rooms such as music, art, library, and physical education, in addition to time in their homeroom class room. Information gathered by EH&E from educational staff indicate that weekly time outside of the homeroom class is 30 minutes in library, 60 minutes in the art room, 60 minutes in the music room, and 60 minutes in the gym per week. For kindergarten children, an additional 10 minutes per day is spent in the music room at dismissal.

Table 2.6 Time and Locations for Children in Estabrook Elementary

Hours	Non-School Day	Normal School			Normal School with Lextended		
		Full Day	Full Day (Cold)	Half Day	Full Day	Full Day (Cold)	Half Day
School (Total)	0	7	7	4	9.75	9.75	9.75
School indoor	0	6.5	7	3.75	8.55	9.75	8.05
School non-classroom	0	1.23	1.73	0.7	2.6	3.8	3.58
School outdoor	0	0.5	0	0.25	1.2	0	1.7
Total indoor	22.2	22.2	22.2	22.2	22.2	22.2	22.2
Total outdoor	1.8	1.8	1.8	1.8	1.8	1.8	1.8

2.2.3.2 *Educational Staff*

Educational staff were reported to be inside the School from 8:00 a.m. to 4:30 p.m. on each school day, except for on short days (each Thursday and assorted other days through the year) when professional development activities were reported to end at 3:15 p.m. Educational staff are assumed to spend the entire time at school in their homeroom classrooms.

2.2.3.3 *Lextended Day*

Potential exposures to PCBs were also evaluated for children in the Lextended Day Program. Lextended Day is a privately run program that provides after school care for children at the School. The time location pattern for this subgroup of the School community provides an opportunity to evaluate the sensitivity of the site-specific assessment to assumptions about time spent in school. Information provided by the School indicates that the Lextended program officially starts at 3:35 p.m. on full-school days and 12:25 p.m. on half-school days. However, for this site-specific assessment the program was assumed to begin upon dismissal (3:15 p.m. on full-school days and 12:15 p.m. on partial school days) and end at 6:00 p.m. Monday through Friday. Based on information received from teachers at the School, children were assumed to spend equal amounts of time in room 31A, library, gym, and outdoors during Lextended sessions, except for periods of outdoor temperatures less than 30 °F when children in the Lextended Day program were assumed to stay indoors.

2.2.4 Risk Characterization

The site specific assessment relies upon three relevant sources of information for characterizing risk of exposure to PCBs.

1. EPA Reference Dose for Aroclor 1254
2. EPA Reference Dose for Aroclor 1016
3. Epidemiological studies of exposure to PCB-containing construction materials

2.2.4.1 Reference Doses

The RfD derived by EPA for Aroclor 1254 and Aroclor 1016 were both used in the site-specific assessment because of similarities between the mixture of PCB homologs observed in indoor air of the School and the respective commercial mixtures. An illustration of the similarities is provided in Figure 2.1 in which the average homolog distribution in indoor air of the School is compared to the homolog distribution for Aroclor 1016 and Aroclor 1254 reported by the ATSDR (ATSDR 2000). As shown in Figure 2.1, PCBs in the air of the School and Aroclor 1016 are primarily composed of three-chlorine and four-chlorine congeners, while five-chlorine and six-chlorine congeners are the most abundant homologs in Aroclor 1254. A summary of both the Aroclor 1254 and Aroclor 1016 RfD is presented in Table 2.7.

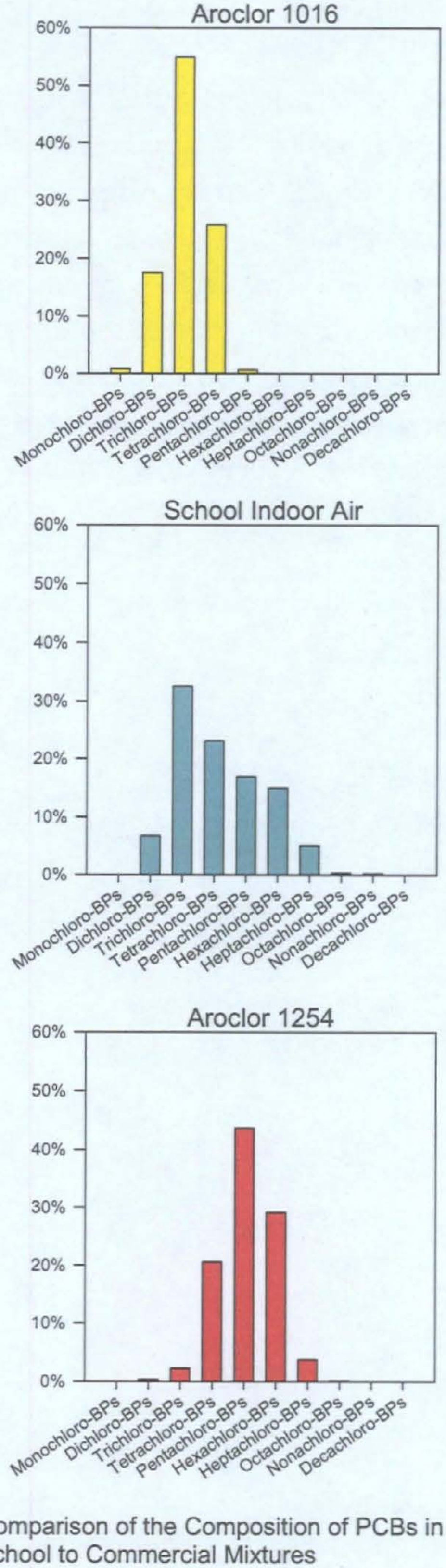

Figure 2.1 Comparison of the Composition of PCBs in Air Samples Inside the School to Commercial Mixtures

Table 2.7 Comparison of EPA Reference Dose for Aroclor 1254 and Aroclor 1016

Parameter	Aroclor 1254[a]	Aroclor 1016[b]
NOAEL	None	0.007 mg/kg-day
LOAEL	0.005 mg/kg-day	0.028 mg/kg-day
Endpoint	Ocular exudate, inflamed and prominent Meibomian glands, distorted growth of finger and toe nails; IgG and IgM antibodies in response to SRBC were reduced after 23 months of exposure but only the IgM antibodies were clearly decreased after 55 months.[c]	Adult monkeys that ingested 0.007 or 0.028 mg/kg-day doses of Aroclor 1016 for approximately 22 months showed no evidence of overt toxicity. Effects occurring in the offspring of these monkeys consisted of hairline hyper-pigmentation at greater than or equal to 0.007 mg/kg-day, and decreased birth weight and possible neurologic impairment at 0.028 mg/kg-day.[d]
Uncertainty Factors	**300 Total** 10 (Sensitive sub-populations) 3 (Inter-species) 10 (LOAEL instead of NOAEL)	**100 Total** 3 (Sensitive sub-populations) 3 (Inter-species) 3 (Limitations of data) 3 (subchronic to chronic)
RfD (Oral)	0.00002 mg/kg-day (20 ng/kg-day)	0.00007 mg/kg-day (70 ng/kg-day)
Confidence in Oral RfD	Study—medium Database—medium RfD—medium	Study—medium Database—medium RfD—medium

EPA U.S. Environmental Protection Agency
NOAEL no observed adverse effect level
LOAEL lowest observed adverse effect level
mg/kg-day milligrams per kilograms per day
RfD reference dose
ng/kg-day nanograms of PCBs per kilogram body weight per day

[a] EPA Integrated Risk Information System (IRIS). Aroclor 1254 (CASRN 11097-69-1). Accessed September 16, 2010. http://www.epa.gov/iris/subst/0389.htm

[b] EPA Integrated Risk Information System (IRIS). Aroclor 1016 (CASRN 12674-11-2). Accessed September 16, 2010. http://www.epa.gov/iris/subst/0462.htm

[c] Principal and Supporting References for Oral RfD for Aroclor 1254:
Arnold DL, Bryce F, Stapley R, et al. 1993a. Toxicological consequences of Aroclor 1254 ingestion by female Rhesus (Macaca mulatta) monkeys, Part 1A: Prebreeding phase - clinical health findings. *Food and Chemical Toxicology*, 31:799-810.
Arnold DL, Bryce F, Karpinski K, et al. 1993b. Toxicological consequences of Aroclor 1254 ingestion by female Rhesus (Macaca mulatta) monkeys, Part 1B: Prebreeding phase - clinical and analytical laboratory findings. *Food and Chemical Toxicology,* 31:811-824.
Tryphonas H, Hayward S, O'Grady L, et al. 1989. Immunotoxicity studies of PCB (Aroclor 1254) in the adult rhesus (Macaca mulatta) monkey - preliminary report. *Int. J. Immunopharmacology*, 11:199-206.
Tryphonas H, Luster MI, Schiffman G, et al. 1991a. Effect of chronic exposure of PCB (Aroclor 1254) on specific and nonspecific immune parameters in the rhesus (Macaca mulatta) monkey. *Fundamental and Applied Toxicology*, 16(4):773-786.
Tryphonas H, Luster MI, White KL, et al. 1991b. Effects of PCB (Aroclor 1254) on non-specific immune parameters in Rhesus (Macaca mulatta) monkeys. *Int. J. Immunopharmacology,* 13:639-648.

[d] Principal and Supporting References for Oral RfD for Aroclor 1016:
Barsotti DA and van Miller JP. 1984. Accumulation of a commercial polychlorinated biphenyl mixture (Aroclor 1016) in adult rhesus monkeys and their nursing infants. *Toxicology*, 30:31-44.
Levin ED, Schantz SL and Bowman RE. 1988. Delayed spatial alternation deficits resulting from perinatal PCB exposure in monkeys. *Archives of Toxicology*, 62:267-273.
Schantz SL, Levin ED, Bowman RE, et al. 1989. Effects of perinatal PCB exposure on discrimination-reversal learning in monkeys. *Neurotoxicology and Teratology,* 11:243-250.
Schantz SL, Levin ED and Bowman RE. 1991. Long-term neurobehavioral effects of perinatal polychlorinated biphenyl (PCB) exposure in monkeys. *Environmental Toxicology and Chemistry,* 10:747-756.

In both the EH&E site-specific and EPA generic assessments, the calculated rate of exposure to PCBs is compared to the RfD for Aroclor 1254, a manufactured mixture of PCBs that was used for many purposes, including as a component of construction materials commonly found in schools. The EPA derived the RfD for this mixture of PCBs by applying an uncertainty factor of 300 to the lowest dose of PCBs found to produce an effect during a laboratory test with animals. In the laboratory test, rhesus monkeys were fed high concentrations of PCBs for more than five years. The lowest amount of PCBs fed to the monkeys was about 500 times higher than levels to which humans routinely encounter PCBs in food and air. EPA took the lowest dose that led to any adverse effects in the monkeys, and then divided that by 300 to account for uncertainties about differences between monkeys and humans, duration of the test compared to duration of a lifetime, and differences in how sensitive individuals might respond. The resulting value is the RfD that is used as a benchmark for evaluating exposures to Aroclor 1254.

The RfD for Aroclor 1016 (70 ng/kg-day) was also derived from laboratory studies with rhesus monkeys and is 3.5 times higher than the RfD for Aroclor 1254 (20 ng/kg-day). The direction of the difference indicates that the mixture of PCBs in Aroclor 1016 is less potent toxicologically than Aroclor 1254. Use of the RfD for both Aroclor 1254 and Aroclor 1016 provides a plausible range of dose-response information for use in the site-specific assessment considering the mixture of PCBs present in indoor air of the School.

2.2.4.2 Epidemiologic Studies

In addition to reliance upon RfDs, risk assessments for PCB exposure through inhalation can also be informed by evaluating results of relevant epidemiological studies. The vast majority of epidemiological studies that report associations between human health and PCBs are based on (i) contrasts in the prevalence of a certain health status between groups with differential levels of PCBs in blood serum or other tissue or (ii) contrasts of PCB concentrations in blood serum or other tissue between groups with and without a specific illness or disease.

EH&E performed a detailed search and review of the scientific literature that focused on PCB body burdens among occupants of buildings with indoor air impacted by PCB-containing construction materials. Findings from those studies were considered in the context of exposure conditions within the School, primarily the concentrations of PCBs measured in indoor air of the building.

2.2.5. Assessment Scenarios

The site-specific exposure calculator was applied to four scenarios (A – D) that were developed to address specific assessment questions. In each scenario, the output of the analysis is an estimate of the average concentration of PCBs in indoor air of the School that yields an exposure rate equivalent to the RfD for Aroclor 1254 and Aroclor 1016, including background exposures (Scenario C only accounts for exposures at the School). For scenarios A – C, exposure calculations were performed for several age groups: 3 to less than 6 years old, 6 to less than 12 years old, and staff.

2.2.5.1 Scenario A: November 7, 2010 – November 6, 2011

This scenario addresses a target for PCBs in indoor air of the School in consideration of exposures over one calendar year beginning the week of November 7, 2010. The start date for this scenario reflects an annual period during which students, teachers, and staff members are expected to occupy their regularly assigned rooms and engage in their regularly scheduled activities. Using the 2010-2011 academic calendar, it is possible to calculate the target concentrations of PCBs. The RfD for Aroclor 1254 is 20 nanograms per kilogram of body weight per day. We can find the target concentrations for each group by adjusting the concentration for the time from November 7, 2010, to November 6, 2011, until the daily exposure for a child in pre-school is equal to the RfD.

2.2.5.2 Scenario B: August 31, 2010 – August 30, 2011

This scenario addresses a target for PCBs in indoor air of the School in consideration of exposures over one calendar year beginning on the first day of school for students in the 2010 – 2011 academic calendar. The date range for this scenario reflects a full year that includes PCB concentrations in air to which students were exposed prior to mitigation of PCBs in construction materials of the school. As a result, this scenario considers actual conditions in the School during the present academic year in the estimate of target concentrations for the remainder of the year. Details of activity patterns and exposure concentrations for Scenario B, during the various stages of the remedial actions taken, are provided in Tables 2.8 and 2.9; target concentrations are calculated for the period following November 7, 2010.

Table 2.8 Timeline for Scenario B of the Site-Specific Risk Assessment, Estabrook Elementary, Lexington, Massachusetts

Time Period	Number of Full-Day Equivalent School Days	School Activities	Building Remediation Activity
8/31/2010 through 9/11/2010	1.5/2	Partial day on 8/31 for K students; full day on 9/1; no students inside school building during second week of school	PCB-containing caulk removed from exterior window frames and window glazing encapsulated
9/12/2010 through 9/18/2010	4.5	Regular school schedule	Improved ventilation throughout school; supplemental ventilation in Rooms 1 – 4
9/19/2010 through 9/25/2010	4.5	Regular school schedule	Further improvements to ventilation; continued supplemental ventilation in Rooms 1 – 4; encapsulation of interior caulk.
9/26/2010 through 11/6/2010	24	Regular school schedule. All kindergarten classes in modular rooms (Room7A-C)	Evaluation of remaining contributions to indoor air PCBs, Rooms 1 – 6.
11/7/2010 through 8/30/2011	123	Regular school schedule	To be determined

PCB polychlorinated biphenyl

Table 2.9 Inputs for Scenario B of the Site-Specific Risk Assessment, Estabrook Elementary, Lexington, Massachusetts

Time Period	Homeroom Indoor Air PCB Concentration (ng m^{-3})	Special Classroom PCB Concentration (ng m^{-3})
3 to <6 Years		
8/31/2010 through 9/11/2010	460	460
9/12/2010 through 9/18/2010	120	190
9/19/2010 through 9/25/2010	63	97
9/26/2010 through 11/6/2010	5	5
6 to <12 Years		
8/31/2010 through 9/11/2010	460	460
9/12/2010 through 9/18/2010	370	190
9/19/2010 through 9/25/2010	180	97
9/26/2010 through 10/2/2010	180	97
10/3/2010 through 11/6/2010	310	194
Staff		
8/31/2010 through 9/11/2010	460	460
9/12/2010 through 9/18/2010	370	190
9/19/2010 through 9/25/2010	180	97
9/26/2010 through 11/6/2010	180	97
10/3/2010 through 11/6/2010	310	194

PCB polychlorinated biphenyl
ng m^{-3} nanograms per cubic meter

Using Tables 2.8 and 2.9, it is possible to calculate the target concentrations of PCBs. As stated above, the RfD for Aroclor 1254 is 20 nanograms per kilogram of body weight per day. We can again find the target concentrations for each group by adjusting the concentration for the time from November 7, 2010, to August 31, 2011, until the daily exposure for a child in pre-school is equal to the RfD.

2.2.5.3 Scenario C: August 31, 2010 – August 30, 2011, No Background Exposure

This scenario addresses a target for PCBs in indoor air of the school that is specific to exposures occurring during school hours, a period during which the Town of Lexington has an ability to influence concentrations and activities. In other words, background exposure to PCBs is not considered in this scenario. Otherwise, the exposure concentrations and activity patterns for Scenario C are the same as those for Scenario B. So same process is followed for finding the target concentration as for Scenario B, only in Scenario C, background exposures are excluded.

2.2.5.4 Scenario D: Kindergarten – Twelfth Grade

This scenario addresses a target for PCBs in indoor air of the School in consideration of exposures over a hypothetical 13-year period in the LPS system. Long-term average exposure is considered for a student who is currently a fifth grader at the School and who was also a student at Estabrook School from Kindergarten through fourth grade. The time scale and cohort for this scenario reflects a 6-year accumulation of School-related exposure. Because these children are assumed to have the longest duration of School-related background exposure to PCBs, the results for this group are also health protective for children who are currently in Grade 4 or lower. The relevance of this scenario is that the RfD for PCBs according to EPA is 20 nanograms per kilogram of body weight per day for a lifetime. This means that if a child is exposed to a very high concentration of PCBs for a relatively short period of time and a low concentration for a long period of time the health risks are mitigated. Details of exposure concentrations and activity patterns for Scenario D are provided in Table 2.10. Using this table, it is possible to calculate the target concentration by using the concentrations for the years given and adjusting the concentrations for the School until the average exposure over the entire time that a student is in the LPS system is equal to the RfD for Aroclor 1254.

2.2.6 Calculating Concentrations in the School

By measuring PCB concentrations in both homerooms and non-homerooms (art, music, gym, etc.) shows that concentrations in the homerooms are around two times the values of non-homerooms. In addition, measurements of concentrations with the ventilations systems both on and off yields that the concentration in the classroom is approximately doubled when the ventilation systems are off. Using these assumptions, the concentrations of PCBs, and scenario specific assumptions, it is possible to calculate target concentrations for the four scenarios.

Table 2.10 Inputs of Annual Average Concentrations of PCBs in Indoor Air to the Site-specific Risk Assessment as well as Selected Intermediate Outputs for Scenario D, Estabrook Elementary, Lexington, Massachusetts

School	Estabrook Elementary School						Middle School			High School			
Grade	**K**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Inputs to the Site-Specific Risk Assessment													
School indoor concentration (ng/m^3)	459[a]	459	459	459	459	–[b]	45[c]	45	45	45	45	45	45
Intermediate Outputs of the Site-Specific Risk Assessment													
School-related exposure (ng/kg-day)	36	36	36	36	36	–[b]	1.6	1.6	1.6	1.6	1.4	1.4	1.4
Background exposure (ng/kg-day)	6.7	4.2	4.2	4.2	4.2	–[b]	2.9	2.9	2.9	2.9	2.7	2.7	2.7
Total exposure (ng/kg-day)	43	40	40	40	40	–[b]	4.5	4.5	4.5	4.5	4.1	4.1	4.1

PCBs polychlorinated biphenyls
ng/m^3 nanograms per cubic meter
ng/kg-day nanograms of PCBs per kilogram body weight per day

a Median concentration of total PCBs in indoor air of the School measured on July 22, 2010.
b Concentration for Grade 5 is calculated subject to period average exposures for grades K – 4 and 6 – 12 and both the Aroclor 1254 and Aroclor 1016 benchmarks.
c Median concentration of total PCBs in indoor air of Clarke Middle School on July 21, 2010.

3.0 RESULTS

3.1 BACKGROUND EXPOSURE (SCENARIOS A, B AND D)

Aggregate background exposure for ages 3 to less than 6 years old was 4.6 and 5.7 ng/kg-day for school and non-school days, respectively. Background exposures were lower for 6 – <12 year old children and adults. PCBs in food and indoor air outside of school accounted for greater than 95% of aggregate background exposure for all age groups.

Table 3.1 Background Exposure by Pathway and Age Group, Site-specific Assessment, Estabrook Elementary School, Lexington, Massachusetts

Pathway	Exposure (ng/kg-day)	
	School Day	**Non-school Day**
3 to <6 Years		
Indoor Inhalation	2.6	3.7
Outdoor Inhalation	0.02	0.02
Ingestion-soil/dust	0.03	0.03
Dermal-dust	0.01	0.01
Diet	1.9	1.9
Aggregate Background	**4.6**	**5.7**
6 to <12 Years		
Indoor Inhalation	1.7	2.4
Outdoor Inhalation	0.02	0.02
Ingestion-soil/dust	0.02	0.02
Dermal-dust	0.01	0.01
Diet	1.2	1.2
Aggregate Background	**3.0**	**3.7**
Staff		
Indoor Inhalation	0.85	1.4
Outdoor Inhalation	0.01	0.01
Ingestion-soil/dust	0.01	0.01
Dermal-dust	0.01	0.01
Diet	1.7	1.7
Aggregate Background	**2.6**	**3.1**

ng/kg-day nanograms of PCBs per kilogram body weight per day

3.2 SITE-SPECIFIC TARGETS FOR PCBS IN INDOOR AIR

The average concentrations of PCBs in indoor air of the School that yield time-weighted average daily exposures equivalent to the RfDs for Aroclor 1016 and 1254 are listed in

Table 3.2. The concentrations for a child in the age range of 3 to less than 6 years old range from 230 nanograms per cubic meter (ng/m^3) based on the Aroclor 1254 RfD for Scenario A and B to 1,100 ng/m^3 for Scenario C and the Aroclor 1016 RfD. Because children in this age group are assumed to have the highest rate of background exposure to PCBs, these concentrations are health protective for older ages as well. These target indoor air concentrations for the homeroom classes in the School reflect the background PCB exposure rates and in-school conditions described previously for each scenario.

Table 3.2 Estimated Targets for Concentrations (ng/m^3) of Polychlorinated Biphenyls in Indoor Air of Homeroom Classrooms, Estabrook Elementary School, Lexington, Massachusetts, for Three Scenarios

Scenario		Target Concentration in Indoor Air	
Identifier	Description	Aroclor 1254 RfD[a]	Aroclor 1016 RfD[b]
3 to <6 Years			
A	November 7, 2010 – November 6, 2011	<230	<990
B	August 31, 2010 – August 30, 2011	<230	<1,010
C	August 31, 2010 – August 30, 2011, No Background	<310	<1,100
6 to <12 Years			
A	November 7, 2010 – November 6, 2011	<380	<1,500
B	August 31, 2010 – August 30, 2011	<380	<1,500
C	August 31, 2010 – August 30, 2011, No Background	<460	<1,600
Staff			
A	November 7, 2010 – November 6, 2011	<450	<1,800
B	August 31, 2010 – August 30, 2011	<460	<1,800
C	August 31, 2010 – August 30, 2011, No Background	<540	<1,900

ng/m^3 nanograms per cubic meter
RfD reference dose for chronic exposure developed by U.S. Environmental Protection Agency

[a] RfD of 20 nanograms Aroclor 1254 per kilogram body weight per day.
[b] RfD of 70 nanograms Aroclor 1016 per kilogram body weight per day.

The site-specific indoor air target concentration for Scenario D, a current fifth grade student who attended Estabrook from kindergarten through fourth grade, is 1,400 ng/m^3 for Aroclor 1254 and 11,300 ng/m^3 for Aroclor 1016. However, it should be noted that Scenario D does not provide a conservative figure regarding PCB exposure to elementary school students.

3.3 SIMULATED SITE-SPECIFIC TOTAL EXPOSURE

As described in Section 2.1, daily exposure to PCBs from background sources while at the School were calculated for Scenarios A and B based on the academic calendar for LPS. Maximum concentrations of PCBs in indoor air of the School were computed from the difference between background exposure rates and the RfD for Aroclor 1254 and Aroclor 1016, respectively. Time-weighted average indoor air concentrations of PCBs at the School were subject to the heating and non-heating season constraints described in Section 2.2.

An example of the time-series of temporal variation in exposure simulated by this approach is illustrated in Figure 3.1 using results for the 3 – 6 years age group. Although the simulation was conducted with temporal resolution of one day, weekly average results are shown in the figure to facilitate viewing. Daily average exposures over each week are the sum of background and school-related exposure. The profile shown in the figure reflects an annual average concentration of PCBs in classroom air of 230 ng/m^3, which corresponds to an average daily exposure equal to the RfD for Aroclor 1254 (20 ng/kg-day). Daily average minima shown in the plot correspond to weeks when school is not in session and reflect background exposure. Daily average maxima correspond to weeks when school is in session during the heating season and reflect background plus school-related exposure. Values between the minimum and maximum represent weeks that include both school and non-school days.

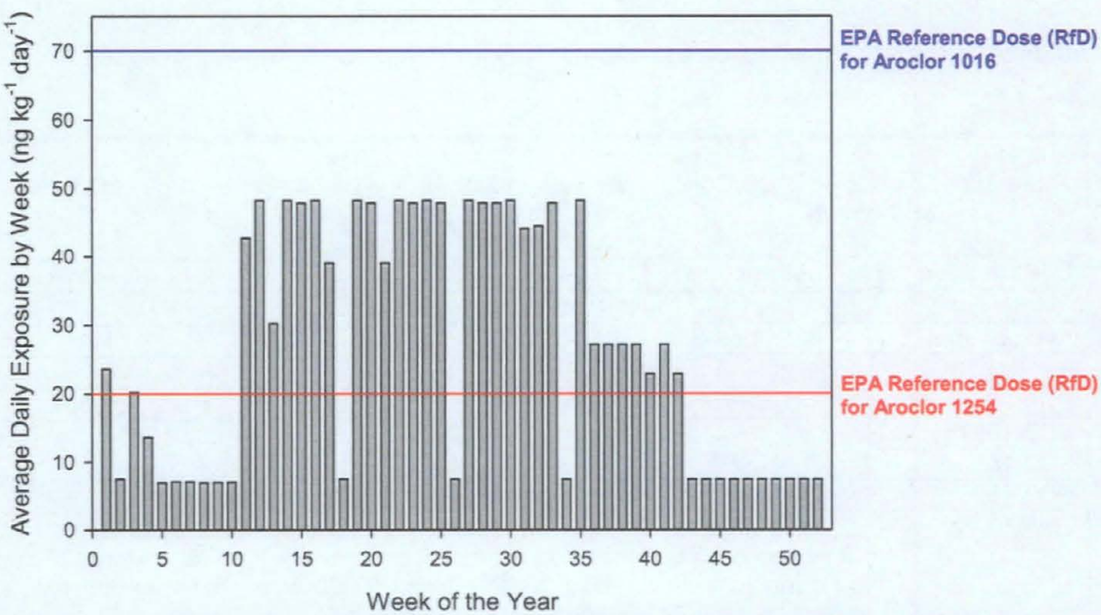

Figure 3.1 Average Daily Exposure to PCBs Arising from an Annual Average Concentration of PCBs in Classroom Air of 230 ng/m^3 and Site-Specific Background Sources of Exposure, which Leads to Annual Average Daily Exposure of 20 ng/kg-day, the EPA Reference Dose for Aroclor 1254

3.4 REVIEW OF EPIDEMIOLOGIC STUDIES

EH&E has not found any study to date that reports adverse health effects in children or adults who have occupied buildings with airborne levels of PCBs equivalent to those in the School. In addition, studies published in the scientific literature indicate that exposure to PCBs in indoor air of buildings with concentrations similar to the School does not result in increased amounts of total PCBs in the blood when compared to a reference population.

Gabrio et al. (2000) studied PCBs in blood of 151 teachers from 3 schools with PCB-containing materials (mean PCB indoor air concentration: 635 ng/m^3, 3,541 ng/m^3, 7,490 ng/m^3) and 2 control schools. Concentrations of three higher chlorinated PCB congeners in blood did not differ among the four groups (control schools considered as a single group). No statistically significant difference was found in PCB congener levels for occupants of the school with the lowest average PCB concentration indoor air of 635 ng/m^3, although the average concentration was nominally higher compared to the control group (Table 3.3). In addition, the lighter PCBs comprised a small fraction of total

PCB body burden. Consequently, Gabrio et al. (2000) concluded that indoor air concentrations composed of mixtures of lower chlorinated PCBs below 1,000 ng/m^3 do not have a discernible effect on the overall PCB level in blood of those individuals.

Table 3.3 Overview of PCB Concentrations in Indoor Air and Blood from a Study of Schools in Germany[1]

Parameter	School 1	School 2	School 3	Control
Total PCBs in Air (ng/m^3)				
Average (max)	635 (1,587)	7,490 (10,655)	3,541 (10,125)	NA
PCBs in Blood (µg/L)				
PCB 28	0.045	0.098	0.057	0.035
PCB 138	0.66			
PCB 153	0.95			
PCB 180	0.7			
Total PCBs	"Taking together the present results and observations of other authors, it may be concluded that indoor air concentrations with PCB mixtures of low and medium chlorination, that are below 1,000 ng/m^3 have no observable effect to the PCB level of exposed individuals."			

PCB polychlorinated biphenyl
ng/m^3 nanograms per cubic meter
NA not available
µg/L micrograms per liter

1 Gabrio T, et al. 2000. PCB-blood levels in teachers, working in PCB-contaminated schools. *Chemosphere 40*: 1055-1062.

Similar results are reported in other epidemiologic investigations of adults in schools with PCB-containing construction materials. In a study of 18 teachers in a school with PCBs present in indoor air (maximum indoor air concentration >12,000 ng/m^3), the authors report an increase in low chlorinated congeners (PCB 28 and PCB 52) in blood but conclude that this contribution is small when compared to total PCB body burden (Schwenk et al. 2002).

Additional epidemiologic studies conducted in schools also report a lack of association between body burdens of total PCBs and indoor air concentrations in the range of, or higher than, the levels observed at the School. Blood samples taken from 77 teachers in a building with indoor air PCB concentrations greater than 1,000 ng/m^3 in several rooms did not contain elevated levels of PCBs (Burkhardt et al. 1990). PCBs in blood of 18 teachers working in a school with PCB-containing construction materials (range: 4,580 – 13,500 ng/m^3) were not statistically different from an age and gender matched control population of 18 teachers from a control building (Ewers et al. 1998). A similar lack of association between PCB body burden and indoor air concentrations was reported in a study of 32 women who worked in nursery schools with PCB-containing construction materials (Heudorf et al. 1995) (average air concentration: 709 ng/m^3; maximum air concentration: 1,489 ng/m^3) and in a study of staff and students (Heudorf et al. 1996) (maximum air concentration: 3,200 ng/m^3).

Specific to studies of children, PCBs in blood plasma of 377 students attending a school with elevated PCBs in indoor air (median: 2,044 ng/m^3; range: 690 – 20,800 ng/m^3) were compared to 218 students in a school without PCB-containing construction materials (Liebl et al. 2004). The authors report higher concentrations of lower chlorinated congeners (PCB 28, 52, 101) in students of the school with PCB-containing construction materials but no difference in higher chlorinated congeners between the two groups. Total concentrations of PCBs in both groups were dominated by higher molecular weight congeners that were present at concentrations 1 to 2 orders of magnitude greater than the lower molecular weight congeners. As a result, the authors conclude that, "the detected excess body burden was very low indicating no additional health risk" (Liebl et al. 2004).

A study specific to elementary school children found that PCB concentrations in blood for those attending class in a building with PCB-containing construction materials (indoor air concentration up to 10,220 ng/m^3) were not different when compared to children from five representative areas (Neisel et al. 1999).

EH&E's own study of over 80 individuals in a building with elevated levels of PCBs in indoor air found no association between levels of over 50 specific congeners in blood serum and length of residency in the building.[1] Instead, variability of PCB levels in blood serum of this cohort was primarily related to age and gender, probably reflecting accumulation from food over time and differences in diet or other lifestyle attributes between men and women.

[1] Although unpublished to protect confidentiality of the client and participants, the design and results of this study were reviewed by EPA Region 1 and an independent group of public health scientists.

4.0 DISCUSSION

This report describes the current version of a site-specific risk assessment conducted to identify targets for concentrations of PCBs in indoor air of the School and to inform risk management and risk communication activities. Further refinements to the site-specific risk assessment will be made if additional information on potential exposures becomes available.

The site-specific risk assessment produced target indoor air concentrations of PCBs for children ages 3 to less than 6 years old that are approximately 2-fold greater than results derived for the same age group in a generic assessment conducted by EPA. Differences between the site-specific and EPA assessment are attributable primarily to two factors. First, background exposure to PCBs in the site-specific assessment is approximately 50% lower than in the EPA assessment. The difference in background exposure is the result of using the latest information on PCB levels in food available from the FDA. In addition, children at the School spend approximately 20% of their time each week in special classes (e.g., art, music, and library) located outside of their regular classroom and where airborne PCB concentrations in those locations have been shown to be approximately 50% less than in regular classrooms.

4.1 Strengths of the Site-Specific Risk Assessment

A principal strength of this assessment is the use of time-location patterns specific to students and staff of the School. Information on time-location patterns was initially gathered through a survey instrument supplied to the School administration by EH&E. Subsequently, EH&E interviewed a group of teachers and the principal to validate responses to the questionnaire, obtain refined information on daily start and end times at the School, and ascertain details on special classes and services offered in the School. This information was used to explore the sensitivity of results to deviations from the baseline time-location patterns described in the Methodology section.

Use of updated information on dietary exposure to PCBs is another positive attribute of this assessment. The updated information is based on the most recent (2003) FDA study of PCBs in food in which samples of over 250 foods were gathered from retail outlets in four regions of the United States. The 2003 FDA data yield lower background exposures than the dietary intake estimates made by the EPA in its risk assessment for a typical school. The EPA relied upon incomplete data from an earlier (1997) dietary intake study conducted by the FDA. The difference between the 1997 and 2003 dietary exposure data is consistent with the commonly accepted scientific understanding that background concentrations of PCBs in the environment and food supply are decreasing over time. Though this might simply be an artifact of the limitations of the data.

The use of several exposure scenarios is another significant attribute of the site-specific risk assessment. Presentation of multiple scenarios was intended to address the range of interests expressed in the Committee meetings to date. Consideration of both prospective and retrospective exposures, as well as total (i.e., background plus school) and school-only exposures, is intended to inform risk management options more fully than reliance on only a single exposure scenario.

Consideration of site-specific information on measured concentrations of PCBs in the School is another strength of this assessment. Exposure concentrations for the School that were incorporated into the assessment include measurements of PCBs in indoor air, outdoor air, soil, and interior surfaces. In addition to being site-specific and current, these measurements are fully quality assured. Moreover, the provenance and representativeness of these data are also known; attributes which are often not well characterized in many risk assessments.

Incorporation of the RfD for both Aroclor 1016 and Aroclor 1254 as health protective benchmarks also contributes to the rigor of the site-specific assessment. Consideration of both RfDs is an explicit recognition of the similarities between the mixture of PCBs in indoor air of the School and the two commercial mixtures. The use of both benchmarks provides a more complete range of results for consideration by risk managers and the School community.

Finally, the site-specific risk assessment addresses the limitations of animal-based toxicology studies to inform risk characterization and risk management in part by including an evaluation of relevant epidemiological studies. In the case of PCBs in indoor air of schools, no studies have yet been published of health status among occupants of buildings with PCB-containing construction materials in comparison to a reference group. However, epidemiological studies of PCB body burdens among occupants of buildings with PCB-containing construction materials and elevated concentrations of PCBs in indoor air of those buildings have been conducted.

EH&E's evaluation of those studies has shown that exposure to PCBs in indoor air of buildings at concentrations similar to, and in most cases much higher than, levels measured in the School does not result in increased amounts of total PCBs in the blood when compared to a reference population. The lack of association between body burdens and occupancy of buildings with indoor air concentrations in the range of those measured in the School is an indication that PCB vapors at the School are unlikely to pose a substantive risk to health.

Several epidemiologic studies specific to inhalation exposure in PCB-contaminated schools found elevated concentrations of lighter PCB congeners in blood compared to reference groups. However, the contribution of these lighter congeners to total PCB body burden was minimal. Further, for risk-based comparisons using published RfDs, it is important to consider that the lighter congeners comprise a small fraction of Aroclor 1254 (<3% di- and tri-chlorinated biphenyls) whereas Aroclor 1016 is dominated by lighter congeners (>70% di- and tri-chlorinated biphenyls). EPA's current approach to evaluating risk associated with PCB inhalation exposure in schools is based on the RfD for Aroclor 1254. The epidemiologic evidence suggests that evaluations of health risk associated with inhalation of PCBs released from building materials are characterized equally well by using the RfD for Aroclor 1016 or Aroclor 1254. The choice of which RfD to use can have significant impacts on evaluating exposure risks in PCB-contaminated buildings because the RfD for Aroclor 1016 is 3.5 times higher than the RfD for Aroclor 1254.

4.2 Uncertainty

In addition to having numerous notable strengths, the site-specific risk assessment is also subject to uncertainty about actual exposure to PCBs and the level of health risk that corresponds to that exposure. As cited in the World Health Organization guidance on *Uncertainty and Data Quality in Exposure Assessment*, consideration of these uncertainties is an important element of a human health risk assessment.

> *"Constraints, uncertainties, and assumptions having an impact on the risk assessment should be explicitly considered at each step in the risk assessment and documented in a transparent manner. Expression of uncertainty or variability in risk estimates may be qualitative or quantitative, but should be quantified to the extent that is scientifically achievable."*

Incomplete information about actual levels of background exposure to PCBs is one area of uncertainty in the site-specific risk assessment. As part of a sensitivity analysis, estimates of background exposure of the School community were re-calculated based upon concentrations of PCBs in background outdoor air, soil, and interior dust measurements made in reference homes located in New Bedford, Massachusetts (Vorhees et al. 1997 and 1999). Because New Bedford has a history of significant PCB contamination, there is some concern that reference areas in New Bedford are not representative of background PCB exposures in the School community. In particular, reliance on the New Bedford data may lead to overestimates of background PCB exposure among occupants of the School. PCB concentrations in indoor and outdoor air of reference homes from New Bedford and used in the sensitivity analysis are shown in Table 2.4. The results of this sensitivity analysis indicate that the target indoor air concentrations would decrease by 10% for Scenario A and B, and 19% for Scenario D, assuming background exposure in the School community is more reflective of New Bedford, Massachusetts, than national average values.

Actual exposure to PCBs in food for the School community is another source of uncertainty in the site-specific risk assessment. As noted previously in this report, estimates of background dietary exposure were based upon results of the 2003 TDS, a national survey of PCBs and other substances in food conducted by the FDA. These dietary exposure data indicate that PCBs are present above FDA method detection limits in only two foods: salmon and catfish. The estimate of background dietary exposure for children ages 3 to less than 6 years old assumes that a 1.07 gram serving of salmon and 0.85 gram serving of catfish is consumed every day on average, according to results of a food consumption survey conducted by the U.S. Department of Agriculture. Infrequent consumers of these fish may experience substantially less dietary ingestion of PCBs than the estimate of 2 ng/kg-day derived from the 2003 data.

Another interesting feature of the dietary data is that background exposure to PCBs through food for the 3 to less than 6 years old age group decreased approximately 60% between the 1997 and 2003 FDA surveys of foods. The downward trend suggested by these data is consistent with evidence from other studies that background concentrations of PCBs in the environment are decreasing over time (e.g., Venier and Hites 2010). In one recent study, per capita dietary intake of PCBs was reported to be 33 nanograms per day or approximately 0.5 ng/kg-day for a 70 kg adult (Schecter et al. 2010). This exposure rate is approximately three times less than background dietary exposure estimated from the 2003 TDS data and four times less than the EPA estimates derived from 1997 TDS data. Therefore, current dietary exposure to PCBs in the School community may be lower than estimates derived from the 2003 data. However, this might simply be an artifact of the limitations of the data. In addition, in the dietary intake values are based solely on foods in which PCBs were detected, meaning that exposure from food may be higher if PCBs are present in levels below current detection limit. The effect of any such difference on the results of this assessment would be to increase PCB levels in indoor air of the School that are commensurate with rates of PCB exposure equivalent to the RfD for either Aroclor 1254 or Aroclor 1016.

Variability of dietary exposure to PCBs among individuals raises other aspects of accounting for background exposure in the site-specific risk assessment. For instance, food consumption patterns of people who occupy the School have not been quantified. Likewise, PCB levels in foods of markets in and around Lexington, Massachusetts have not been quantified. As a result, no site-specific information on background dietary exposure to PCBs is available at this time. Moreover, ingestion of foods that contain PCBs cannot be controlled, or perhaps even influenced, by the Town or School. The lack of complete information about background dietary exposure to PCBs, and variability of dietary intake among individuals, contributes to uncertainty in the site-specific risk assessment.

The potential impact of uncertainty around dietary ingestion was evaluated by conducting a sensitivity analysis. First, uncertainty surrounding data differences from the 1997 and 2003 FDA diet data was evaluated. The method used in the site-specific risk assessment to estimate daily dose from food ingestion used concentrations reported in 2003 for two types of food with detectable levels of PCBs (catfish and salmon); all other food types had PCBs less than the limit of detection and were therefore excluded from the analysis. When this approach was applied to the 1997 data used in EPA's generic assessment, our estimate of daily dose was approximately 20% less than the 8 ng/kg-day reported by EPA. Unfortunately, detailed information on how EPA handled data for foods with non-detectable levels of PCBs is unavailable and the 20% discrepancy cannot be resolved. To estimate the impact of this uncertainty in the site-specific risk assessment, we re-calculated the indoor air target levels assuming a 20% increase in background dose from diet which yielded values of 220 ng/m^3 for Scenarios A and B (Scenario C estimates remain unchanged). Second, uncertainty exists when using 2003 diet data to reflect exposures in 2010. Background dietary exposure decreased by approximately 60% between EPA's estimate using 1997 data and the site-specific assessment using data from 2003 (8 v. 2 ng/kg-day). Assuming a linear change over time, dietary dose in 2010 would be expected to be approximately 1.2 ng/kg-day (2 ng/kg-day * 60%). This would correspond to target air levels of 240 ng/m^3 for Scenarios A and B (as before, Scenario C estimates remain unchanged).

Assumptions about prior exposure to PCBs in the School are a source of uncertainty about the results for Scenario D, which consider 5 years of retrospective exposure. Actual concentrations of PCBs in indoor air of the school during that time period are unknown. It is known, however, that concentrations are related to ventilation and ambient conditions. Many factors influence ventilation including time of day, exhaust fan operation, supply fan operation, thermostat setting, and use of operable windows. These factors are likely to have varied over time and among rooms in the School. With regard to ambient conditions, it should be noted that first round of air samples from the School was collected under summer conditions, which because of elevated temperatures, may represent worst-case conditions for emissions of PCBs to the air. In EH&E's experience, PCB levels in buildings often change with the seasons, with greatest emissions found in the heat of the summer months.

Assumptions about time in school are another source of uncertainty in the assessment. Evaluation of target indoor air concentrations for children in the Lextended after-school program is useful for characterizing the upper bound of potential targets for indoor air concentrations of PCBs. Results for the Lextended Day scenario are shown in Table 4.1 and are approximately 25% lower than the baseline estimates.

Table 4.1 Lextended School Scenario

Identifier	Description	Percent Contribution to the Total Exposure to Reach RfD for Aroclor 1254			Estimated Target Indoor PCB Concentration (ng/m^3)
		Background (%)	School (%)	Lextended School Program (%)	
3 to <6 Years					
A	November 7, 2010 – November 6, 2011	25	57	19	<170
B	August 31, 2010 – August 30, 2011	25	56	20	<170
C	Time in School, August 31, 2010 – August 30, 2011	0	75	26	<230
6 to <12 Years					
A	November 7, 2010 – November 6, 2011	17	63	21	<280
B	August 31, 2010 – August 30, 2011	17	63	21	<290
C	Time in School, August 31, 2010 – August 30, 2011	0	75	25	<350

RfD reference dose
PCB polychlorinated biphenyl
ng/m^3 nanograms per cubic meter

The range of results derived from the RfD for Aroclor 1016 and Aroclor 1254 also illustrates the scientific uncertainty present in the site-specific risk assessment. Targets for indoor air concentrations obtained from the two RfDs are intended to be protective of health and to reflect exposure concentrations and time-location patterns that are representative of students, teachers, and staff of the School. As shown in Figure 2.1, the distribution of PCB homologs in indoor air of the School is not identical to the homolog distribution for either Aroclor 1016 or Aroclor 1254. Instead, the observed homolog distribution appears to have elements of both commercial mixtures. While other commercial mixtures of PCBs, such as Aroclor 1221 or Aroclor 1242, may also be similar to the distribution of homologs observed in the air of the School, EPA has yet to establish health protective guideline values (e.g., a RfD) for those mixtures of PCBs. Nonetheless, the target indoor air concentrations that correspond to the Aroclor 1016 and Aroclor 1254 RfDs represent a range of health protective results that can be considered by risk managers.

The values of the inhalation rate (IR), body weight (BW), and other constants used in calculation the target concentrations are another source of uncertainty in this assessment. The values of IR and BW are based on data gathered from all over the country and might not be representative of the population of the Town. In addition, the values of BW are highly variable between children in pre-school and simply using the mean value can cause children who are below average weight to be exposed to concentrations that are higher than the RfD. In addition, the value used for the IR is for children that are engaged in 'sedentary and passive activities', such as sitting and standing still, which is not the type of activities that are typical in a pre-school. Instead a value of IR, 16.7 cubic meters per day (EPA 2008), is selected based on estimations of the general activity patterns of the target age group (children in pre-school). Changing the value of IR provides a more conservative estimation of target concentrations of PCBs in the School. The target concentrations for Scenarios A, B, and C are found in Table 4.2.

Table 4.2 Estimated Targets for Concentrations (ng/m^3) of Polychlorinated Biphenyls in Indoor Air with IR value of 16.7 m^3/day

Scenario		Target Concentration in Indoor Air	
Identifier	**Description**	**Aroclor 1254 RfD[a]**	**Aroclor 1016 RfD[b]**
A	November 7, 2010 – November 6, 2011	<130	<630
B	August 31, 2010 – August 30, 2011	<130	<640
C	Time in School, August 31, 2010 – August 30, 2011	<200	<710

ng/m^3 nanograms per cubic meter
RfD reference dose for chronic exposure developed by U.S. Environmental Protection Agency
m^3/day cubic meter per day

a RfD of 20 nanograms Aroclor 1254 per kilogram body weight per day.
b RfD of 70 nanograms Aroclor 1016 per kilogram body weight per day.

Uncertainty in the site-specific risk assessment is also related to the methods and information used by EPA to develop the RfDs for Aroclor 1016 and Aroclor 1254. As described in detail by EPA and summarized in Table 2.4, the RfDs were derived from laboratory studies of rhesus monkeys that ingested high concentrations of the respective commercial mixtures. The lowest amount of PCBs fed to the monkeys was up to 500 times higher than levels to which humans routinely encounter PCBs in food and air. The EPA took the lowest dose that led to any adverse effects in the monkeys, and then divided that by 100 for Aroclor 1016 and by 300 for Aroclor 1254 to account for uncertainties about differences between monkeys and humans, duration of the test, sensitive individuals, and other limitations of the tests. In addition to relying upon those extrapolations when estimating target indoor air concentrations of PCBs in schools, both EPA and EH&E assumed that PCBs present the same hazards to health whether ingested or inhaled.

Extrapolation of toxicological results from laboratory studies of animals fed high amounts of commercial mixtures of PCBs to inhalation of much lower amounts of a different mixture of PCBs in schools presents substantial scientific uncertainty. As noted previously, EPA applied an uncertainty factor of 300 to the lowest dose of PCBs found to produce an effect during the laboratory tests with animals to account for the uncertainty in extrapolating that result to humans. Because the uncertainty factor was applied in only one direction and animals are known to sometimes be more sensitive than humans to effects of chemical exposure, the uncertainty factor is similar to a 'safety factor'. Regardless of the terminology, the RfDs for Aroclor 1016 and Aroclor 1254 are not based on scientific studies of PCB exposure and effects in humans. In EH&E's view therefore, the RfDs, and target indoor air concentrations derived from them, are most appropriately characterized as human health protective, but not human health-based. Uncertainty associated with the use of the RfDs as an input to the assessment is addressed in part by knowledge of levels of PCBs in blood serum in relation to indoor air concentrations of PCBs from epidemiologic investigations.

5.0 SUMMARY AND CONCLUSION

EH&E completed a site-specific assessment of human health risk for PCBs at the School to help understand and manage potential risks. The objective of the assessment was to identify targets for concentrations of PCBs in indoor air of the School. These targets are available to support risk management and risk communication activities by the Town.

Application of conventional methods for quantitative risk assessment to various exposure scenarios and two benchmarks for chronic exposure produced a range of target concentrations for PCBs in indoor air of the School. The lowest target concentration for the annual average concentration of PCBs in indoor air of a classroom in the School derived from the site-specific assessment is 230 ng/m^3. This value corresponds to an average daily exposure equivalent to the RfD for Aroclor 1254 recommended by EPA. The mixture of PCBs in indoor air of the School is different from the mixture of PCBs in Aroclor 1254 and in fact also resembles the mixture of PCBs in Aroclor 1016. The lowest site-specific target concentration for PCBs in indoor air of a classroom in the School derived from the RfD for Aroclor 1016 is 990 ng/m^3.

Principal uncertainties identified in the quantitative risk assessment include incomplete information on background exposure to PCBs for the School population and the type and likelihood of adverse effects in humans associated with inhalation of the mixture of PCBs present in indoor air of the School. Results of the quantitative risk assessment are further informed by studies of human populations known to have occupied buildings with PCB concentrations in indoor air similar to the levels observed in the School. These studies have not found associations between occupancy of the building and body burdens of total PCBs. Because epidemiological studies that report adverse effects of PCBs are predicated on elevated body burdens of total PCBs, the lack of association between body burdens and occupancy of buildings with indoor air concentrations in the range of those measured in the School is an indication that PCB vapors at the School are unlikely to pose a substantive risk to health. The concentration of PCBs in humans is commonly understood to be largely related to age and gender, probably reflecting accumulation from food over time and differences in diet or other lifestyle attributes between men and women. That evidence provides further confidence that health risks at the School would only arise from long-term exposure to higher levels of PCBs than those found at the School.

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APPENDIX A

LIMITATIONS

LIMITATIONS

1. Environmental Health & Engineering, Inc.'s (EH&E) indoor environmental quality assessment described in the attached report number 17228, *Site-Specific Assessment for Polychlorinated Biphenyls, Estabrook School, Lexington, Massachusetts* (hereafter "the Report"), was performed in accordance with generally accepted practices employed by other consultants undertaking similar studies at the same time and in the same geographical area; and EH&E observed that degree of care and skill generally exercised by such other consultants under similar circumstances and conditions. The observations described in the Report were made under the conditions stated therein. The conclusions presented in the Report were based solely upon the services described therein, and not on scientific tasks or procedures beyond the scope of described services.

2. Observations were made of the site as indicated within the Report. Where access to portions of the site was unavailable or limited, EH&E renders no opinion as to the condition of that portion of the site.

3. The observations and recommendations contained in the Report are based on limited environmental sampling and visual observation, and were arrived at in accordance with generally accepted standards of industrial hygiene practice. The sampling and observations conducted at the site were limited in scope and, therefore, cannot be considered representative of areas not sampled or observed.

4. When an outside laboratory conducted sample analyses, EH&E relied upon the data provided and did not conduct an independent evaluation of the reliability of these data.

5. The purpose of the Report was to assess the characteristics of the subject site as stated within the Report. No specific attempt was made to verify compliance by any party with all federal, state, or local laws and regulations.

ATTACHMENT D

OPERATIONS AND MAINTENANCE PLAN FOR POLYCHLORINATED BIPHENYLS ESTABROOK ELEMENTARY SCHOOL LEXINGTON, MASSACHUSETTS

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EH&E Report #17228
February 25, 2011

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LIST OF ABBREVIATIONS AND ACRONYMS

Building	Estabrook Elementary School
EH&E	Environmental Health & Engineering, Inc.
EPA	U.S. Environmental Protection Agency
Estabrook	Estabrook Elementary School
ng/m^3	nanograms per cubic meter
O&M	operations and maintenance
PCB	polychlorinated biphenyl
PM	Project Manager
ppm	parts per million
School	Estabrook Elementary School
SOP	standard operating procedure
$\mu g/100\ cm^2$	micrograms per 100 square centimeters

1.0 PURPOSE AND OVERVIEW

1.1 INTENT

The purpose of the Estabrook Elementary School (Estabrook) Operations and Maintenance (O&M) Plan for polychlorinated biphenyls (PCBs) is to:

- Recognize, control, and mitigate potential PCB hazards at Estabrook.
- Ensure the continued health and safety of students, staff, visitors, contractors, vendors, and the community.
- Maintain compliance with occupational and environmental regulations pertaining to PCBs.
- Implement proactive maintenance activity reviews to identify work with the potential to disturb PCB-containing materials.
- Maintain air and surface concentrations of PCBs below established health based guidelines.
- Ensure adequate ventilation is provided to Estabrook.
- Specify environmental sampling schedules and plans.

1.2 OVERVIEW

This plan describes operations and maintenance procedures for the continued management and control of PCBs at Estabrook Elementary School (the School), Lexington, Massachusetts, prepared by Environmental Health & Engineering, Inc. (EH&E) for the Town of Lexington.

The following are the key tenets for the Estabrook O&M Plan:

- Potential exposure to airborne PCBs shall be controlled to as low as reasonably achievable, and comply with the current site specific risk assessment indoor air school year average value of 200 nanograms per cubic meter (ng m^{-3}).

- Potential exposure to PCBs in surface dust shall be controlled to as low as reasonably achievable, and in all cases surface dust PCB concentrations shall comply with the criteria set forth by the U.S. Environmental Protection Agency (EPA) of 10 microgram per 100 cubic centimeters ($\mu g/100\ cm^2$).

- Potential exposure to PCBs on encapsulated surfaces shall be controlled to as low as reasonably achievable, and in all cases comply with risk-based criterion set forth by the EPA of 1 $\mu g/100\ cm^2$.

- All projects or work activities that may potentially disturb PCBs shall be evaluated by Lexington Facilities Management to determine if precautions are required (e.g., inspection, testing, abatement).

- Only qualified and trained personnel shall perform activities that will potentially disturb PCB-containing materials at Estabrook.

- Lexington Department of Facilities shall be responsible for ensuring that the associated program elements are observed.

- PCB awareness training will be provided to teachers, staff, and Lexington employees.

- PCB remediation and hazardous materials training will be provide to selected Lexington Department of Facilities employees.

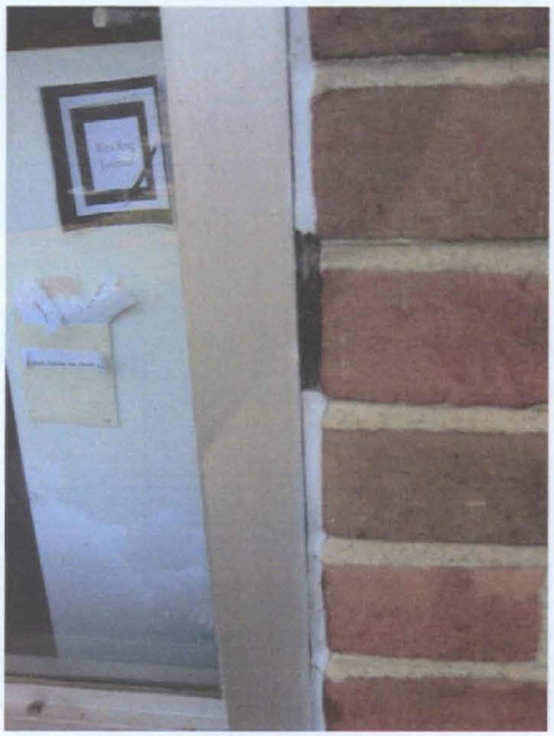
- All Lexington staff, contractors, and vendors are responsible for reporting any condition or activity that could result in the disturbance of PCBs to Lexington Facilities Management.

- All accidental disturbances and/or releases of PCBs shall be reported immediately to Lexington Facilities Management for evaluation and follow up.

The following sections describe the PCB management program for Estabrook. Appendix A provides a listing of current key Lexington employees with responsibilities under this O&M Plan and their contact information. Appendix B includes an inventory summary of identified and presumed materials that contain PCBs at Estabrook. Appendix C provides a revision history of this plan. Appendix D provides standard operating procedures for repairs and renovation activities. Appendix E provides the recommended HVAC operating procedures.

2.0 PROJECT BACKGROUND

Environmental Health & Engineering, Inc. (EH&E) performed an initial investigation in June 2010 to identify suspect PCB-containing caulking and sealants used throughout portions of the School. EH&E collected samples of exterior caulking and inspected the caulking for evidence indicating window caulking replacement or repair work. Five unique types of caulking were identified and sampled. One of the five types of caulking contained PCB concentrations between 6,000 and 21,000 parts per million (ppm). Photograph 2.1 depicts this caulking material and the typical installation detail between the metal window frame and brick façade. Photograph 2.2 depicts a typical section of the school façade.



Photograph 2.1 Typical Caulking Detail

Photograph 2.2 Typical Façade Section

In July of 2010 air samples for PCB homolog concentrations were collected in the School. Results indicated indoor air concentrations of total PCBs above the public health levels for annual average concentrations suggested by the EPA. In August of 2010, window glazing and sealants were also sampled to identify other potential sources of PCBs that may be contributing to the measured levels in the indoor air. The glazing and sealant samples contained concentrations of PCBs between 0.89 and 150 ppm.

In response to these findings, EPA was notified and the Town of Lexington conducted cleanup activities that included: removal of 550 linear feet of PCB containing caulking, decontamination of the non-porous metal window frame surface to less than or equal to 10 micrograms per 100 square centimeters (10 $\mu g/100\ cm^2$), and encapsulation of the porous brick material with a two-part epoxy encapsulant. The remediation process also addressed the non-porous metal window frames by cleaning them to a post-abatement criterion of 10 $\mu g/100\ cm^2$ or less.

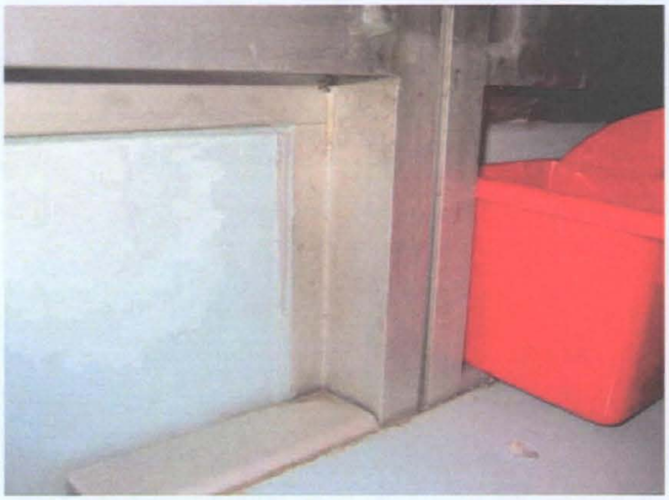
Window sealant and glazing compounds on the interior and exterior of the School's windows were encapsulated using a two-part system comprised of bond breaker tape and silicone caulk. The bond breaker tape provided the necessary PCB barrier, and the silicone caulk provided the necessary adhering qualities and weatherization. Representative sections of the encapsulated areas were sampled using surface wipes to ensure the criterion set forth by the EPA of 1 microgram per 100 square centimeters ($\mu g/100\ cm^2$) or less was met.

Results of the post remediation wipe samples collected in August of 2010 and issued to EPA in a September 1, 2010, report indicated that representative sections of the encapsulated areas were all less than the criterion set forth by the EPA of 1 $\mu g/100\ cm^2$. After remediation work activities had been completed and unit ventilators had run overnight for at least 10 hours, an additional round of air sampling was conducted. Results indicated that airborne concentrations still exceed the suggested public health levels provided by the EPA.

Based on these air sampling results, additional actions were implemented to improve indoor air quality in the school including steps to increase the amount of outdoor air ventilation. The testing also indicated that an additional source(s) of PCBs was present in the School and was contributing to the levels of PCBs observed in the indoor air. EH&E conducted further source characterization activities at the School intended to identify materials that were making a substantive contribution to indoor air PCB concentrations. This further source characterization included a detailed inspection of suspect materials such as ceiling tiles, light fixtures, unit ventilator components, paints, glues, mastics, and other interior sealant and adhesive materials and additional sampling of indoor air, surfaces, and/or bulk materials.

The next round of indoor air samples collected on September 6, 2010, indicated that modifications to the existing ventilation systems made to maximize delivery of outdoor air into the building substantially improved the levels PCBs in indoor air. Many rooms were below the public health targets suggested by EPA and the results demonstrated that indoor air levels could be partially managed through ventilation. At this same time, bulk sampling identified a narrow bead of caulk around interior seams of wall panels likely to be an important source of indoor PCBs. Photograph 2.3 depicts an example of this caulking bead. Ceiling tiles were identified as a secondary source of PCBs during this round of sampling and activities were planned to measure the impact of the ceiling tiles on indoor air PCB concentrations. Further, wipe samples collected from eleven indoor surfaces such as desk tops indicated concentrations all less than 1 $\mu g/100\ cm^2$

suggesting that elevated levels of PCBs in source materials were not adversely impacting surface dust at the School.



Photograph 2.3 Caulking on Interior Panel within Window Frame

Prior to collection of the September 19, 2010, round of air samples, interior beads of PCB-containing caulk located below the ceiling plenum were encapsulated following the methodology accepted by EPA. Comparison of these post encapsulation test results to concentrations measured in the third round of sampling provided information on changes in indoor air levels of PCBs. The results of this round of testing demonstrated continued progress in controlling concentrations of PCBs in indoor air of the School. The concentrations of PCBs in indoor air were below 200 nanograms per cubic meter (ng/m^3) in each room sampled on September 19, 2010. This result held even for the two rooms (13 and 24) in which the unit ventilators were operating with the outdoor air damper in the minimum open position.

Test conditions were then developed to evaluate the impact of the ceiling tiles on the indoor air PCB concentration at the School by isolating the ceiling tiles from the classroom with polyethylene sheeting. Results suggested that the indoor air concentrations when the ceiling tiles were isolated from the classroom were very similar to those observed prior to isolation of the ceiling tiles. The average PCB homolog air concentration in Round 5 was 155 ng/m^3. In comparison, the average concentration in the same rooms sampled during Round 4 was 151 ng/m^3. The results of this testing indicated that any emissions from ceiling tiles was not a substantive contributor to PCB levels in indoor air of these classrooms. These results emphasized the importance of continuing to manage interior PCB-containing caulk, including additional encapsulation.

The results from the sixth round of testing collected on September 28 and 29, 2010 in Rooms 2 and 5 were consistent with previous measurements during periods of reduced ventilation. In contrast, the results for Room 1 and Room 6 indicated the influence of factors not directly related to ventilation. The effects of these factors on levels of PCBs in indoor air of the School warranted further investigation.

On October 18 and 19, 2010, two hypotheses were tested on sources and methods of mitigating PCBs remaining in indoor air of the school. The first hypothesis was that the release of PCBs from the curtain walls (window assembly) continued to contribute to PCB levels in indoor air. The second hypothesis was that there was a release of PCBs from within the unit ventilator cabinets contributing to PCB levels in indoor air. The hypotheses testing results indicated that the curtain walls continued to be a source of PCB emissions and that the PCB levels in indoor air could be managed further by sealing penetrations in components of the curtain wall and by minimizing the heating of caulk on the interior of the curtain wall. The test results also indicate that unit ventilators were not an important source of PCB levels observed in indoor air.

Based in part on these results, plans were made for additional near-term mitigation at the school that included sealing specific components of the curtain wall, suspending use of stand-alone steam radiators (i.e., radiators that are not integral to the unit ventilators), and encapsulating transite panels below the window sills of the curtain walls. This was achieved by constructing a mini-wall in each room to encapsulate the lower panels of the curtain wall thereby separating them from indoor air of the classroom. The mini-wall constructed in Room 6 is depicted in Photograph 2.4. In addition, I-beam chases were enclosed and specific areas related to the curtain wall were sealed with new caulk or foam insulation. Areas sealed included edges of the mini-wall, metal-to-metal joints of aluminum framing, and original caulking at the intersection of horizontal and vertical aluminum frames.

Photograph 2.4 Mini-wall Installed in Room 6

Mini-wall construction was completed throughout the school and was evaluated with multiple rounds of air sampling on November 4, 11, 20, 24, and December 2, 2010. A graphical summary of the PCB concentration measured in indoor air of Estabrook between July 22 and December 2, 2010, is provided in Figure 2.1. A total of 36 post mini-wall encapsulation air samples were collected all under winter ventilation conditions. The mean indoor air PCB concentration based on these samples is 88 ng/m^3. The results indicate that the 95% confidence interval for the mean is 74 ng/m^3 to 102 ng/m^3. These results demonstrate the effectiveness of the mitigation methods employed in Estabrook.

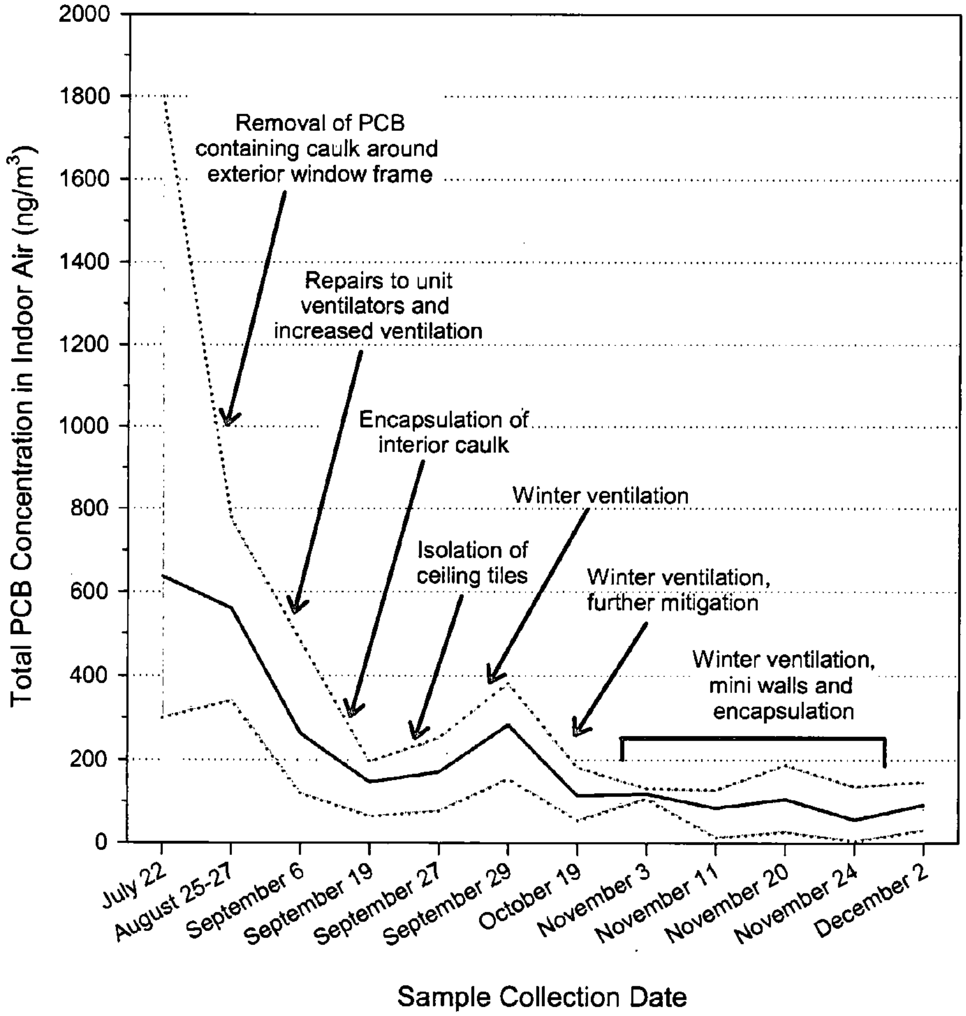


Figure 2.1 Average (line) and Range (shaded area) of Total PCB Concentration in Indoor Air over Time

The actions taken to date have reduced PCB exposures for staff and children to within the guidance values provided by EPA and the site-specific risk assessment. The Operations and Maintenance Plan described in this report was developed to ensure continued mitigation of potential risks associated with PCB in building materials at the School.

3.0 ROLES AND RESPONSIBILITIES

3.1 ROLES AND RESPONSIBILITIES

The Estabrook O&M Plan applies to the Estabrook Elementary School located at 117 Grove Street, Lexington, Massachusetts. This Plan applies to the following type of work:

- Planned renovations projects.
- In-house repairs, maintenance, and remodeling work that may disturb PCBs.
- O&M activities to maintain encapsulated PCBs in acceptable condition.
- Disposal of PCBs, if necessary.

3.2 LEXINGTON MANAGEMENT

Lexington recognizes that clearly defining the departmental roles and responsibilities, including mechanisms to track the various program elements, are critical to the success of the O&M Plan. Lexington has the responsibility of notifying all employees, contractors, and vendors who may work in areas with PCBs that these materials are present and managed as part of this O&M Plan.

The following sections outline Lexington management, O&M employees, and contractor roles and responsibilities under this program; current Lexington management personnel are listed in Appendix A.

3.2.1 PCBs Program Coordinator or Designee

The PCBs Program Coordinator or his/her designee has the following responsibilities:

- Audit compliance with Lexington policies and state and federal regulations pertaining to PCBs.
- Conduct annual reviews of the program.
- Coordinate PCB awareness training for Lexington personnel (e.g., teachers, staff, management, maintenance, cleaning).

- Outline and/or communicate the PCB-related training requirements for other Lexington personnel that may need training above the awareness level.
- Document that periodic surveillance is conducted of all known PCBs four times per year in February, April, August, and December.
- Document that periodic ventilation measurements are conducted four times per year in February, April, August, and December.
- Ensure an inventory of PCBs is maintained and updated.
- Respond to events involving the potential disturbance or release of PCBs.
- Coordinate air monitoring for exposure assessment purposes, three times per year in February, August, and November.
- Maintain PCB-related documentation.
- Be aware of, review, and approve all PCB-related tasks being performed at Estabrook.

3.2.2 Director of Project Management or Designee

The Director of Project Management and the individual Project Manager (PM) or their designees have the following responsibilities:

- Management of all PCB related tasks/responsibilities in the construction renovation process within their projects/areas.
- Schedule PCB inspections when required for projects.
- Ensure that contractors are aware of the Estabrook PCB policies prior to initiation of construction, renovation or maintenance activities.
- Notify the PCB Program Coordinator prior to the initiation of all PCB-related work activities at Estabrook.

3.2.3 Maintenance Managers or Designees

Maintenance Managers or their designees have the following responsibilities:

- Confirm that all O&M tasks that are conducted by maintenance and housekeeping are in compliance with Lexington policy.
- Ensure maintenance and housekeeping employees receive proper training in PCB hazards and O&M tasks.
- Report any PCB materials that may be damaged or have the potential to be damaged to the PCB Program Coordinator.
- Manage all PCB-related tasks/responsibilities during routine and emergency O&M activities.
- Ensure that contractors are aware of Lexington PCB policies prior to initiation of O&M activities.
- Notify the PCB Program Coordinator prior to the initiation of all PCB-related work activities at Estabrook.

3.3 OPERATIONS AND MAINTENANCE EMPLOYEES

Only trained Lexington employees may conduct work activities that disturb PCB containing material. However, some employees, including maintenance and custodial staff, will conduct O&M activities where PCBs may be present and have the following responsibilities:

- Inform their supervisors of any potential PCB material.
- Prevent the disturbance or removal of PCB material.
- Inform the PCB Program Coordinator of any potentially damaged PCB material.

At Estabrook, the removal and/or disturbance of PCBs will occur only during construction, renovation, emergency building system repairs, or when the material is found to be damaged or has the potential to be damaged. Only trained Lexington employees will engage in any work activity that disturbs, impacts or involves the removal of PCBs.

3.4 CONSULTANTS AND CONTRACTORS

Work activities that involve disturbing PCBs may also be conducted by approved, qualified, and licensed contractors and/or consultants. Lexington Facilities and PM Department personnel will maintain copies of contracts and licenses of personnel performing work on PCB-related projects in their office.

The following sections describe the roles and responsibilities of PCB contractors and consultants.

3.4.1 PCB Inspectors

When project specific PCB inspections are required, independent consultants will be used to inspect for PCBs within the designed area/project. The responsibilities of the PCB consultant include:

- Conduct the PCB inspection within the assigned area based upon industry guidelines and regulatory standards.
- Ensure that all samples are analyzed at accredited laboratories and comply with industry guidelines and regulatory standards.
- Report all PCB inspection results to their contact in the Facilities and Project Management Departments and/or the PCB Program Coordinator in a timely manner.

3.4.2 PCB Abatement Contractors

When PCB abatement activities require independent contractors to be used, the responsibilities of the PCB abatement contractors include:

- Conduct the PCB abatement within the assigned areas in accordance with industry guidelines and regulatory standards.
- Maintain all licenses and certifications required to conduct PCB abatement.
- Complete the required abatement closeout packages and return to their contact in the Facilities and Project Management Departments and/or the PCB Program Coordinator in a timely manner.

3.5 OTHER CONTRACTORS

3.5.1 General Contractors

Lexington's project general contractors (GCs) have numerous responsibilities in maintaining safe work environments at Estabrook during construction and renovation projects. GCs will generally not be directly involved with PCB abatement activities; however, renovation and demolition activities within projects shall occur subsequent to the PCB inspection and abatement activities when necessary. The project GCs responsibilities related to PCBs include:

- Avoid any activities that may potentially disturb PCBs (e.g., demolition) prior to the PCB inspections and abatement when necessary.

- Alert the PM and the PCB Program Coordinator immediately upon discovering that PCBs may have been disturbed or released. Assist in securing the area at the direction of the PM and PCB Program Coordinator.

3.5.2 Subcontractors

Project subcontractors are responsible for performance of their work related to all Lexington project requirements, including those regarding PCBs. Subcontractors of project GCs, will generally not be directly involved with PCB abatement. Renovations and demolition activities within projects shall occur after the PCB inspection and abatement activities.. The project subcontractor's responsibilities related to PCB include:

- Avoid any activities that may potentially disturb PCBs (e.g., demolition) prior to a pre-construction meeting, PCB inspections, and abatement, when necessary.
- Report the discovery of any suspect PCB material to the PCB Program Coordinator.
- Report any potential disturbance or release of PCBs to the PCB Program Coordinator.

4.0 PROGRAM ADMINISTRATION

4.1 TRAINING REQUIREMENTS

The following describes the required levels of training related to the O&M Plan. All Lexington employees and contractors who perform O&M activities in areas where PCBs are present shall receive general PCB awareness training. All outside contractors involved in PCB-related work must maintain all of the required training and licenses as required by state and federal regulations and guidelines pertaining to PCBs.

4.1.1 Operations Maintenance Staff and Contractors

Activities likely to disturb PCBs will be carried out only by the properly trained Lexington employees. However, maintenance and custodial staff may work in areas where PCBs are present. All contractors performing routine O&M that may unintentionally disturb PCBs are required to provide training for their employees in accordance with the following.

All maintenance or custodial staff (or other employees) who perform housekeeping or maintenance activities in areas where PCBs are present, will receive general PCB awareness training annually, typically 1 – 2 hours. Training will cover:

- Health and safety hazards of PCBs
- Location of PCBs at Estabrook
- Recognition of damaged or deteriorated PCB-containing materials
- Housekeeping standard operating procedures
- Response to potential PCB release episodes
- Overview of the Estabrook O&M Plan

4.1.2 Hazardous Materials Training

Activities likely to disturb PCBs will be carried out only by properly trained Lexington employees or qualified remediation contractors. The employees responsible for performing these maintenance activities will receive 40-hour Hazardous Waste Operations and Emergency Response Standard (HAZWOPER) training.

HAZWOPER training is for workers that perform activities that expose or potentially expose them to hazardous substances. The training is specifically designed for workers who are involved in clean-up operations, voluntary clean-up operations, emergency response operations, and storage, disposal, or treatment of hazardous substances. Topics include protection against hazardous chemicals, elimination of hazardous chemicals, safety of workers and the environment.

Table 4.1 summarizes the minimum training requirements for Lexington staff, contractors, and vendors who may work in areas where PCBs are present.

Table 4.1 Summary of Minimum PCB Training Requirements for Lexington Personnel

Personnel Category	Type of Training	Training Frequency
Specially Trained Maintenance Staff	HAZWOPER (40-hour training course)	Initial training with 8-hour refresher annually thereafter
Facilities Department Managers	Awareness level	Annual
Facilities Department Staff	Awareness level	Annual
Project Managers	Awareness level	Annual
Other Lexington personnel potentially involved in O&M activities (e.g., custodial)	Awareness level	Annual
Project General Contractors and Subcontractors	Awareness level	Annual

PCB polychlorinated biphenyl
HAZWOPER Hazardous Waste Operations and Emergency Response
O&M Operations and Maintenance

4.2 HAZARD COMMUNICATION

Lexington will notify contractor contacts/representatives of the presence of PCBs that the contractor's employees or subcontractors may contact. Lexington will ensure that the appropriate level and amount of information is available to affected staff, occupants, and visitors to Estabrook. The goal of the PCB hazard communication program is to provide the necessary information so that individuals can take the appropriate level of precaution to minimize potential exposures without unduly and unnecessarily alarming building occupants.

4.3 INVENTORY

Lexington will provide a list summarizing the types of locations that will be maintained by the PCB Program Coordinator. The list will also provide details including material type, location, approximate quantity, and condition of the PCB material, along with dates of inspection, sample collection, or abatement. Appendix B includes and inventory summary of identified and presumed PCBs at Estabrook.

4.4 INCIDENT REPORTING

Any incident, accident, or emergency where PCBs may have been released must be reported to the PCB Program Coordinator immediately. All response actions pertaining to the release are performed in accordance with all state and federal regulatory requirements for notification, clean-up, repair or removal.

4.5 INSPECTIONS

The PCB Program Coordinator will perform or designate qualified personnel to perform detailed inspections of PCB-containing materials at Estabrook four times per year (February, April, August, and December) or more frequently if conditions warrant. The primary goal of these inspections is to identify PCB materials that may be in a condition, such as significantly damaged, that it could pose a potential hazard and should be abated or repaired. The inspections will be documented and included as part of the Estabrook PCB inventory. The inspections will include location, quantity, and condition of PCB materials. Corrective actions will be performed as required to address any issues identified during the visual inspections.

4.6 RECORDKEEPING

The PCBs Program Manager or designee will maintain all records as related to PCBs at Estabrook.

4.7 PROGRAM REVIEW AND REVISION

The O&M Plan will be reviewed on an annual basis by the PCBs Program Manager, or the designated qualified personnel, to include changes in regulations and management processes at Estabrook. A review will also be performed of the PCBs inventory to assure that areas of Estabrook where PCBs exist are inspected routinely and records are maintained appropriately. All revisions to the O&M Plan will be recorded in Table C.1 of Appendix C.

5.0 PCB RELATED ACTIVITIES

5.1 PCB RELATED ACTIVITIES

Lexington manages PCBs related to two main types of activities: O&M activities and renovation activities. In general, O&M activities are managed by the Facilities Department and renovation activities are managed through the Project Management Department. O&M activities include routine maintenance of the Estabrook building systems and components. O&M activities are primarily conducted by the Lexington Maintenance Department. Some O&M activities are also conducted by the Custodial Department.

Renovation activities are construction related projects that include demolition and/or renovation of Estabrook. Renovation activities are managed by Lexington's Project Management Department and are primarily conducted by construction contractors (e.g., project general contractor and subcontractors).

5.2 OPERATIONS AND MAINTENANCE ACTIVITIES

All O&M tasks that may potentially disturb PCBs shall be reviewed for their impact on PCBs prior to conducting the task. Once reviewed, O&M tasks will include, where necessary, engineering and administrative controls to ensure that the tasks are conducted without disturbing the PCBs. Examples of O&M tasks that would potentially disturb PCBs may include, but are not limited to: removal of ceiling tiles, window repair activities, and any repair activities associated with curtain walls. The Facilities Department can develop and customize standard operating procedures (SOPs) for routine activities to facilitate this work. These procedures must be reviewed and approved by the PCB Program Coordinator. General SOPs for renovation and repair work and small response tasks are provided in Appendix D.

5.2.1 Maintenance Activities

O&M activities or routine activities performed by facilities maintenance personnel may involve situations where PCBs may be present, but not disturbed. Where these instances exist, the employee encountering the material must not contact, disturb or work on or around the PCBs. The PCB Coordinator or Program Manager will review the work to be done, and ensure that, as warranted, appropriately trained personnel perform the work. Where possible, Lexington workers should:

- Avoid sweeping or dry brushing in classrooms (along curtain walls) where the presence of PCB-containing dust or debris is possible.
- Avoid cutting, drilling holes in, or sanding into wall material exterior curtain wall or ceilings.
- To the extent possible, incorporate the use of high efficiency particulate air (HEPA) vacuums during cleaning at Estabrook.

If disturbed or damaged material is identified prior to or during routine maintenance activities, the PCB Program Coordinator must be contacted immediately.

5.2.2 Housekeeping Activities

Housekeeping activities performed by custodial staff may involve work in areas where PCBs may be present, but not disturbed. Where these instances exist, the employee encountering the material must not contact, disturb, or work on or around the PCBs. The PCB Coordinator or Program Manager will review the work to be done, and ensure that, as warranted, appropriately trained personnel perform the work.

Housekeeping activities may also involve cleaning of the windows, which have encapsulated PCB materials associated with the sealants. Cleaning and other related activities involving these materials shall include utilizing techniques that minimize the potential for damage to the encapsulated surfaces.

6.0 PCB RESPONSE PLAN

It is not anticipated that PCBs will be impacted or damaged during routine work activities at Estabrook; however, if damaged PCB material is observed or if PCB material is accidentally disturbed, appropriate procedures must be followed to assure safety to workers and surrounding occupants.

These procedures should be followed by any Lexington O&M employee or outside service contractor who is notified of, observes, or causes damage to PCB-containing materials, resulting in an unplanned, accidental, or uncontrolled release of PCBs at Estabrook. It is anticipated that the PCB Program Coordinator would typically manage the response activity as outlined below. These procedures call for notification of appropriate personnel and isolation of the affected area in order to minimize potential release until a training individual or outside contractor arrives to clean up and repair the damage.

6.1 NOTIFICATION

If a Lexington employee or outside service contractor is notified of, observes, or causes damage or disturbance to PCB-containing materials in the building, they should immediately notify their supervisor and the PCB Program Coordinator.

6.2 ISOLATE THE AREA

Responding personnel are responsible for isolating the area of the release from adjacent spaces at the direction of the PCB Program Coordinator:

- Segregate and secure the area to prevent unauthorized access.
- Take steps to prevent further disturbance or damage to the material.
- Evaluate the extent of damage or disturbance of the material, the location, and potential for area occupant exposure.

- Coordinate a remediation effort by trained Lexington staff or professional PCB remediation contractor. This may include repair of the damaged material, or clean-up of observed material. This activity may be performed in conjunction with material sampling and characterization. All clean-up or repair activities must be performed in accordance with regulations for removal, handling, and disposal of PCB-containing materials. PCB waste storage containers and labels may be obtained through the transportation and disposal vendor. Labeling and storage requirements will vary with the quantity and type of building material.

7.0 VENTILATION PLAN

The goal of the Heating and Ventilation Systems Sequence of Operations is to recommend an operating procedure that will ensure that any accumulation of PCBs in indoor air of the School during unoccupied/unventilated hours is reduced prior to occupancy. The recommendation is based on information currently available from previous testing; this recommendation may be refined as additional information is obtained through the ongoing mitigation and air sampling program. A copy of the recommended procedure is provided in Appendix E.

Verification of ventilation rates will be conducted four times per year at Estabrook. These measurements will be conducted in February, April, August, and December. If ventilation does not meet requirements outlined in Appendix E, Lexington will conduct the necessary repairs to the HVAC equipment.

8.0 PCB AIR AND SURFACE SAMPLING PLAN

8.1 SITE SPECIFIC CRITERIA

Potential exposure to airborne PCBs shall be controlled to as low as reasonably achievable, and in all cases comply with the current site-specific risk assessment value of 200 ng m^{-3}.

Potential exposure to PCBs in surface dust shall be controlled to as low as reasonably achievable, and in all cases comply with risk-based criterion set forth by the EPA of 10 $\mu g/100\ cm^2$.

Potential exposure to PCBs on encapsulated surfaces shall be controlled to as low as reasonably achievable, and in all cases comply with the risk-based criterion set forth by the EPA of 1 $\mu g/100\ cm^2$.

Individual sample results greater than seventy-five percent of the site specific criteria will require a follow-up visual assessment of the space to determine if conditions exist that may be contributing to the levels of PCBs in the air or on surfaces. If conditions are identified immediate corrective actions will be taken by Lexington and follow-up sampling will be conducted to evaluate the effectiveness of the corrective actions.

A written report will be issued to EPA upon completion of each round of sampling. All data, quality assurance and quality control data, and supporting documentation will be included in the report. Based on the results, the report will provide the Lexington with specific recommendations as necessary.

8.2 AIR SAMPLING

Air Sampling will be conducted three times per year in February, August, and November. Indoor air samples will be collected at nine locations to characterize potential exposure risks to occupants of Estabrook. Air samples will be analyzed using EPA Method TO-10A for PCB Homolog analysis. Quality assurance and quality control (QA/QC) sampling will include one blank, one duplicate sample, and one ambient (outdoors) air sample.

Analysis and evaluation of the data will be referenced to the published guidelines released by the EPA; the October 20, 2010, Site Specific Risk Assessment; the November 30, 2010, EPA Site Specific Risk Assessment Comments; and the multiple rounds of air sampling data collected throughout Estabrook.

Dates of the air sampling may be adjusted or an additional round or rounds of air sampling may be conducted based on events or work activities in the School.

8.3 SURFACE DUST SAMPLING

Sampling will be conducted three times per year in February, August, and November. Samples will be collected at 10 indoor classroom locations to evaluate potential exposure risks to occupants of Estabrook. Surface samples will be analyzed using EPA Method 8082. Quality assurance and quality control sampling will include one blank, one duplicate sample. Prior to collecting samples, visual inspections of representative areas will be completed to note evidence of dust, debris, or the presence of any PCB source material.

8.4 SURFACE SAMPLING OF ENCAPSULATED MATERIALS

Sampling will be conducted three times per year in February, August, and November. Samples will be collected at 10 locations to evaluate potential exposure risks to occupants of Estabrook. Surface samples will be analyzed using EPA Method 8082. Quality assurance and quality control sampling will include one blank, one duplicate sample. Prior to collecting samples, visual inspections of representative areas will be completed to note any damage to the surfaces.

APPENDIX A

CONTACT INFORMATION FOR LEXINGTON EMPLOYEES

CONTACT INFORMATION

Coordinator: Patrick Goddard, Director of Public Facilities

781-274-8958 pgoddard@lexingtoma.gov

Project Manager: Shawn Newell, Assistant Director of Public Facilities

781-274-8960 snewell@lexingtonma.gov

Operations: Ray Drapeau, Facility Superintendent

781-274-8940 rdrapeau@lexingtonma.gov

Operations: Manny Cabral, Custodial Superintendent

781-274-8930

APPENDIX B

INVENTORY OF IDENTIFIED PCBS AT ESTABROOK

INVENTORY OF IDENTIFIED PCBS AT ESTABROOK

Table B.1 Inventory of PCB-containing Materials at Estabrook Elementary School, 117 Grove Street, Lexington, Massachusetts

Material	Description	Estimated Amount	Encapsulation Status
Window glazing	Material between window glass and metal window frames	6,000 ft	Yes: bond breaker tape and caulking
Ceiling tiles	"Old" ceiling tiles with yellow fiberglass backing	75,000 sq ft	No
Interior panel caulking	Material between curtain wall panels and curtain wall frame	3,000 ft	Yes: mini-wall
Exterior panel caulking	Material between curtain wall panels and curtain wall frame	3,000 ft	Fence
Cove base/ curtain wall	Cover at base of curtain walls	1,200 ft	Yes: mini-wall
Cove base/ curtain wall mastic	Materials between cove base and curtain walls	1,200 ft	Yes: mini-wall
Cove base	Cover at base of walls	–	No
Cover base mastic	Material between cove base and wall	–	No
Exterior frame caulking	Exterior frame caulking has been removed and adjacent materials encapsulated	600 ft	Yes: epoxy and caulking
Interior frame caulking	Caulking between curtain walls and door frames and concrete and brick walls	600 ft	Yes: bond breaker tape, caulking, and mini-wall
Black floor mastic	Floor mastic under tiles	75,000 sq ft	Yes: tiles and floor wax

ft feet
sq ft square feet

APPENDIX C

PCB MANAGEMENT PROGRAM
REVISION HISTORY

PCB MANAGEMENT PROGRAM REVISION HISTORY

Table C.1 Estabrook Elementary School PCBs O&M Plan Revision History

Rev. No.	Effective Date	Description of Change	Author	Approved By

APPENDIX D

REPAIR ACTIVITY STANDARD OPERATING PROCEDURES

REPAIR ACTIVITY STANDARD OPERATING PROCEDURES

This standard operating procedure (SOP) provides precautionary measures and best work practices that will be followed when conducting a repair or renovation where PCB-containing caulk could be encountered or where assumed PCB materials are present. This SOP is based on information provided by the U.S. Environmental Protection Agency (EPA).[1]

The work practices will employ protective measures during a renovation/repair, leave the work area clean and safe for building occupants, and properly dispose of waste materials. Protective measures will always be used to provide direct personal protection of workers and building occupants, as well as to prevent spreading PCB dust to other surrounding areas.

OCCUPATIONAL PROTECTION

Lexington employees will use suitable personal protective equipment (PPE) for dust-generating work methods. PPE will include; chemical-resistant gloves, Tyvec disposable coveralls and shoe covers, safety glasses or protective goggles, and respiratory protection. In addition, eating, drinking, and smoking will be prohibited in the work area. For work involving significant dust generation, showers and separate changing areas for work clothing and everyday clothing will be provided.

COMMUNICATION WITH SCHOOL OCCUPANTS

Clear communication with all stakeholders (e.g., building occupants, workers, teachers, and community members) will be conducted to create a safe working environment. Affected groups will be informed of: the goals, type, and length of the renovation activities; health and safety aspects of the project; and site access requirements and limitations.

Site security measures will be used to prevent access of unauthorized persons to the work areas until after the final cleanup. Security measures will include: signs, locked doors, barrier tape and/or cones to keep all non-workers, especially children, out of the

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[1] http://www.epa.gov/pcbsincaulk/guide/guide-sect2.htm

work area. As needed, trained site personnel will accompany visitors at all times and provide them with appropriate PPE.

WORK AREA SET UP

When working on a renovation or repair job with potential PCB-containing materials, appropriate controls will be put in place to minimize spreading dust during the renovation and/or repair activity. At a minimum, work areas will be protected from non-work areas by constructing containment. Plastic sheeting will be applied to the floor, ground, or other applicable surfaces to prevent contamination of the building interior or exterior from dust generated by the work. Containment will be constructed so that all dust or debris generated by the work remains within the area protected by the plastic. Placing the containment area under negative air pressure will also be used when necessary. Use of high efficiency particulate air (HEPA) filters will be utilized to minimize dust release. The size of the containment area and dust controls that will be used will vary depending on the size of the renovation or repair, the methods used, and the amount of dust and debris that will be generated as a result of the renovation or repair activities. Workers will control the spread of dust outside the work area by vacuuming off Tyvec suits and tools when exiting the work area, removing disposable shoe covers, and wiping or vacuuming shoes so the dust stays inside the work area.

When the job is complete workers will:

- Make sure all trash and debris, including building components, are disposed of properly.
- Vacuum any exposed surfaces, including walls and ceilings, with a HEPA-filtered vacuum cleaner.
- Mist dusty sections of the plastic sheeting with water before taking them down to keep dust from becoming airborne.
- Remove plastic sheeting carefully, by folding it with the dirty side in, taping it shut, and properly disposing of it.
- Vacuum all surfaces again with a HEPA-filtered vacuum cleaner.
- Scrub the work area with a general-purpose cleaner on a wet rag or mop until dust and debris are removed.

- Visually inspect your work to ensure that no dust or debris is present and re-clean the area thoroughly if dust or debris is identified.
- Where required, coordinate surface and/or air sampling of the work area to ensure risk-based criteria are maintained.

SMALL RESPONSE TASKS

Small tasks that involve response to a situation such as a broken ceiling tile or window will involve the following response actions:

- Notify the PCB Program Coordinator with details of the required task.
- Isolate the area. Close doors and move furniture in the immediate area if necessary for access.
- Locate the clean-up kit and portable containment apparatus.
- Choose appropriate personal protective equipment.
- Confine and contain any broken materials and position the portable containment apparatus.
- HEPA vacuum dust and small pieces of solid material.
- Remove the ceiling tile or sections of glass inside the portable containment apparatus.
- Damp wipe all surfaces in immediate area.
- Put all contaminated items (gloves, clothing, etc.) into a sealed container or bag.
- Contact PCB Program Coordinator for PCB waste pick-up and disposal.

APPENDIX E

HEATING AND VENTILATION SYSTEMS SEQUENCE OF OPERATIONS

HEATING AND VENTILATION SYSTEMS SEQUENCE OF OPERATIONS

The goal of this sequence of operations is to recommend an operating procedure that will ensure that any accumulation of polychlorinated biphenyls (PCBs) in indoor air of the Estabrook Elementary School (Estabrook) during unoccupied/unventilated hours is reduced prior to occupancy. The recommendation is based on information currently available based on previous testing; this recommendation may be refined as additional information is obtained through the ongoing mitigation and air sampling program.

Review of the heating and ventilation systems sequence of operations indicates the temperature condition needed to maintain the operating minimum outdoor air flow rate through the unit ventilators. Specifically, the temperature in the space needs to be maintained no lower than approximately 1 degree Fahrenheit (°F) of set-point temperature. For example, if the set-point temperature in the space is set for 70 °F, the outdoor air damper on the unit ventilator will not open to the minimum setting until the space is brought to a condition where the temperature in the space is at least 69 °F.[1]

To achieve this condition in the heating season, the boiler will need to be operated during the occupied hours of the school. Environmental Health & Engineering, Inc. (EH&E) recommends that the boiler and Estabrook be set to operate in occupied mode approximately 3 hours before the school will be occupied. This will allow sufficient time for the boiler to build the necessary steam pressure that will allow the unit ventilators to bring the temperature in the space within the range where the outdoor air damper will open to minimum position. Once the damper is in that position, outdoor air will be delivered into the space, which will increase the rate that indoor air is flushed from Estabrook. Exhaust fans serving classrooms should be sequenced to operate with the unit ventilators in the occupied mode. A detailed description of the ventilation sequence is provided in the following section of this Appendix.

Teachers arrive at the building on school days at approximately 7:30 a.m. and programs continue in the building until approximately 6:00 p.m. It is recommend that during the

[1] Personal communications: Shawn Newell of Lexington School Department, William Dempsey of B.D. Control Service, Inc., and Jerry Ludwig of EH&E, August through November 2010.

heating season, the boiler should be operated as required to maintain steam pressure, and the ventilation system be operated in its Winter Occupied Mode, Monday through Friday, 4:30 a.m. through 6:00 p.m. During times when heating is not required, the school should be operated on the same schedule as in the Summer Occupied Mode, during which time the boiler operation is not required.

It is also recommended that a targeted assessment of building ventilation conditions and PCB levels in air during unoccupied periods be performed. This information will be useful for identifying other opportunities to attain the indoor air goals of the Town of Lexington while minimizing natural gas consumption.

SEQUENCE OF OPERATIONS FOR THE CLASSROOM UNIT VENTILATORS

The unit ventilators in the classrooms at Estabrook School operate using a control sequence that has been commonly used in school buildings for over 50 years. This sequence provides a fixed minimum percentage of outdoor air to meet code requirements when the temperature in the space is close to the thermostat set-point temperature. In this case, approximately 350 cubic feet per minute (cfm) of outdoor air will be provided to the classroom when the temperature in the classroom is between 69 °F and 70 °F, (assuming that the thermostat set-point is 70 °F) (see Figure E.1). When the temperature of the space is less than 68 °F, the outdoor air damper will close, and will be fully closed when the temperature in the space is 67 °F or lower. Likewise, as the temperature in the space rises above the set-point temperature of 70 °F, the outdoor air damper will open to allow more outdoor air into the space to cool the space down.[2]

[2] This logic works well when outdoor air temperature is lower than the desired temperature in the space.

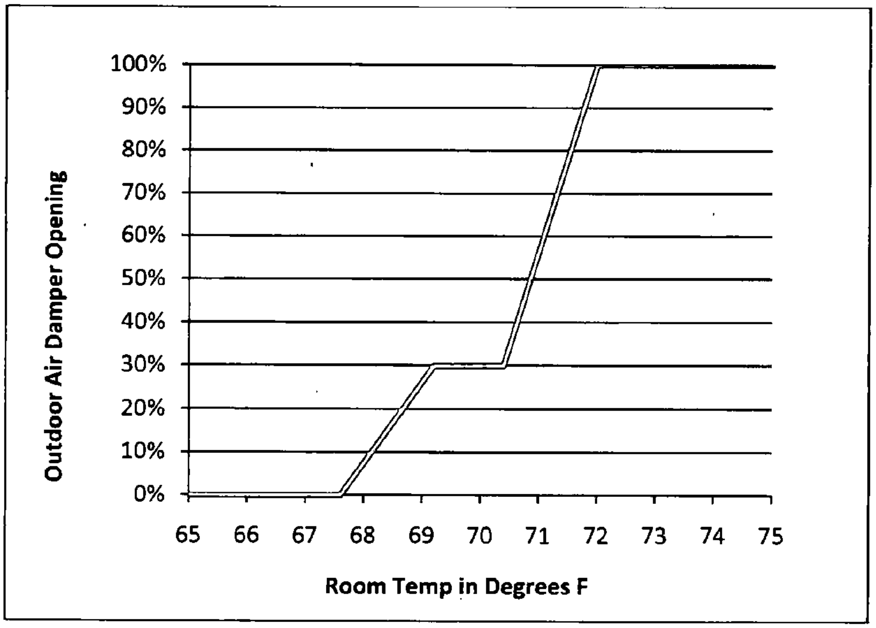

Figure E.1 Position of Outdoor Air Damper of a Classroom Unit Ventilator as a Function of Space Temperature (assuming that space temperature is set for 70 °F)

When the building is in the unoccupied mode, all of the unit ventilators in the building are off and provide no mechanical ventilation of the building. Representative zone temperatures are monitored and will start the boiler and operate the unit ventilators in each classroom of the zone when the zone thermostat senses that the temperature in the zone is less than 60 °F. When this condition is detected, the boiler(s) will fire to provide steam, and the unit ventilators will operate to warm the zones to 65 °F. When the space temperature reaches 65 °F, the boiler and the unit ventilators will again cease to operate. During this un-occupied warm up cycle the outdoor air dampers are still controlled by the logic illustrated in Figure E.1. As the space temperatures remain below 67 °F, the outdoor air dampers will not open and the zone is not provided with mechanical ventilation.

When the building is switched from un-occupied to occupied mode during the heating season, the boiler will fire to provide steam, and the unit ventilators will run to warm the building. As the classrooms warm to 67 °F, the outdoor air dampers will open and begin to ventilate the space at a rate consistent with the minimum occupied code requirement. The exhaust fans will start approximately one-half hour after the unit ventilators to exhaust air from the zone.

The space will be ventilated at this rate until the space temperature exceeds the set-point temperature at which time the outdoor air damper will open beyond the code required minimum position. By the time the temperature in the space reaches 72 °F, the unit ventilator in the space will be providing air that is 100% outdoor air. As the space has many occupants and a significant heat source in lighting, it is not uncommon for the space to heat beyond set-point temperature, even when outdoor air temperatures are around 20 to 30 °F. In this operating condition the classroom unit ventilator is actually cooling the space to prevent overheating. To avoid localized drafts in the vicinity of the unit ventilator, the unit ventilator will not discharge air that is less than 57 °F. While this may feel cold if sensed directly at the unit ventilator, the unit ventilator is working as designed. For this reason, it is advisable that desks of occupants not be situated in close proximity of the unit ventilator.

When the building is switched from unoccupied to occupied mode in the cooling season the unit ventilators will come on to cool the building. If the classroom space has a temperature greater than the space set-point (70 °F), the unit ventilator will provide more than the code required minimum percentage of outdoor air in an attempt to cool the space with outdoor air.

When outdoor air is warmer than the desired space temperature, outdoor air will be brought in at a rate that exceeds the code requirements. While it may not sufficiently cool the space to achieve set-point temperature, it will still be cooling the space; as the temperature indoors will have additional heat sources that are not outdoors such as lights, and the metabolic heat of the occupants.

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MEMORANDUM

TO: Patrick Goddard, Director of Facilities, Town of Lexington
Paul B. Ash, Ph.D., Superintendent, Lexington Public Schools, Estabrook Advisory Committee

FROM: Matt A. Fragala, M.S., C.I.H., Senior Scientist
Joseph G. Allen, D.Sc., Senior Scientist

DATE: March 18, 2011

RE: Air Samples Collected on February 23, 2011, Estabrook Elementary School (EH&E 17228)

This memorandum provides results of the most recent air sampling at Estabrook Elementary School (Estabrook). The objective of the air testing was to measure levels of polychlorinated biphenyls (PCBs) in indoor air of classrooms that have been mitigated according to the interim measures and managed according to the Operation and Maintenance (O&M) Plan.

AIR SAMPLE RESULTS

Air samples were collected in the following areas; Rooms 1, 6, 7C, 13, 21A, 24, and 39C, from approximately 10:00 a.m. – 4:30 p.m. on Wednesday February 23, 2011. Details of the interim measures and other aspects of the current indoor environmental quality (IEQ) management plan are available in the Project Update memorandum dated October 28, 2010, and the materials distributed to the Superintendent's Advisory Committee on November 4, 2010. In addition, detailed plans on the operation of Estabrook are available in the O&M Plan dated January 29, 2011. In brief, a mini-wall was constructed in each room to encapsulate the lower panels of the curtain wall. The mini-wall separates the panels and associated PCB-containing materials from indoor air of the classroom. I-beam chases were enclosed and specific areas related to the curtain wall were sealed with new caulk or foam insulation. Areas sealed included edges of the mini-wall, metal-to-metal joints of aluminum framing, and original caulking at the intersection of horizontal and vertical aluminum frames. Interim measures were completed in Estabrook by the end of November 2010.

Operating conditions for heating and ventilation during the air testing were standard for winter conditions in accordance with the current IEQ management plan included as part of the O&M Plan. The thermostat in each room was set to 70 degrees Fahrenheit.

As shown in Table 1, PCB concentrations in indoor air of the rooms tested ranged from 11 nanograms per cubic meter (ng m^{-3}) to 146 ng m^{-3}. These PCB concentrations are within the most conservative annual average levels for all ages suggested by the site-specific assessment (230 ng m^{-3}). In addition, these concentrations are well below the public health levels for annual average concentrations suggested by the U.S. Environmental Protection Agency (EPA) for children older than 6 years (300 ng m^{-3}) and adults (450 ng m^{-3}). Rooms 6, 7C, 13, 24, and 39C tested were less than the EPA's suggested annual average levels for children less than 6 years old (100 ng m^{-3}).

Table 1 Air Sample Results for Total Polychlorinated Biphenyls, Estabrook Elementary School, 117 Grove Street, Lexington, Massachusetts, July 22, 2010 – February 23, 2011*

Sample Location	Total PCBs (ng/m^3)												
	Round 1[a]	Round 2[b]	Round 3[c]	Round 4[d]	Round 5[e]	Round 6[f]	Round 7[g]	Round 8[h]	Round 9[i]	Round 10[j]	Round 11[k]	Round 12[l]	Round 13[m]
Room 1	299	426	118[‡]	63[‡]	76[‡]	153[†]	145	–	116	–	–	–	146
Room 2	–	775	455	189	166	253[†]	53	–	60	–	–	–	–
Room 3	–	–	–	–	–	364[†]	111	–	110	–	–	–	–
Room 4	–	–	–	–	–	344[†]	126	105	–	–	–	–	–
Room 5	459	736	320	196	149	209[†]	67 – 90	–	128	–	–	–	–
Room 6	1,800	764	483	171	213	383[†]	182	118 – 144	–	–	–	–	97
Room 7A	–	–	5.19	–	–	–	–	–	–	–	34	–	–
Room 7B	–	–	–	–	–	–	–	–	–	–	<5.3	–	–
Room 7C	–	–	–	–	–	–	–	–	–	–	–	–	11-15
Room 11	–	–	–	–	–	–	–	–	65	–	–	–	–
Room 13	319	340	184	155[†]	–	–	–	–	89 – 94	–	–	–	94
Room 19	–	–	–	–	–	–	–	–	12	–	–	–	–
Room 20	–	–	–	–	–	–	–	–	–	57	–	–	–
Room 21A	–	–	410	193	–	–	–	–	–	–	–	109	103
Room 21B	–	–	–	–	–	–	–	–	–	188	–	–	–
Room 22	–	–	–	–	–	–	–	–	–	25	–	–	–
Room 23	–	–	–	–	–	–	–	–	–	142	–	–	–
Room 24	680	601	226	173[†]	–	–	–	–	–	105 – 107	–	–	86
Room 25	–	–	–	–	–	–	–	–	–	130	–	–	–
Room 26	–	–	–	79	–	–	–	–	–	–	47	–	–
Room 27	–	–	–	–	–	–	–	–	–	–	69	–	–
Room 31A	562	575	444	–	–	282	–	–	–	94	–	–	–
Room 31B	–	–	–	–	–	–	–	–	–	135	–	–	–
Room 39B	–	419	–	–	–	–	–	–	–	64	–	–	–
Room 39C	342	495	245	100	–	–	–	–	–	125	–	–	76
Library	–	469	196	–	–	–	–	–	–	–	135	–	–
Art/Music Room	–	–	194	–	–	–	–	–	–	–	–	30	–
Teacher Work Room	–	–	138	–	–	–	–	–	–	–	34	–	
Admin. Offices	–	–	–	–	–	–	–	–	–	–	72	66	–
Teacher Lounge	–	–	–	–	–	–	–	–	–	89	–	–	–
Basement	–	–	227	–	–	–	–	–	–	–	–	–	–

Table 1 Continued

Sample Location	Total PCBs (ng/m³) Round 1[a]	Round 2[b]	Round 3[c]	Round 4[d]	Round 5[e]	Round 6[f]	Round 7[g]	Round 8[h]	Round 9[i]	Round 10[j]	Round 11[k]	Round 12[l]	Round 13[m]
Ceiling plenum (39C)	–	–	562	–	–	–	–	–	–	–	–	–	–
Psychologist Office	–	–	–	–	–	253	–	–	–	–	–	–	–
Gym	–	–	–	–	–	–	–	–	–	–	–	38	–
Sped Office	–	–	–	–	–	–	–	–	–	–	–	134	–
Room B	–	–	–	–	–	–	–	–	–	–	–	148	–
Kitchen	–	–	–	–	–	–	–	–	–	–	–	66	–
Room D	–	–	–	–	–	–	–	–	–	–	–	108	–
Hall Office (Outside Art)	–	–	–	–	–	–	–	–	–	–	–	125	–
Outdoors	<3.79	<5.00	<4.20	<4.46	<4.32	<4.44	<5.54	<4.58	<4.60	<4.08	<5.32	<5.95	<4.37

PCB polychlorinated biphenyl
ng/m^3 nanograms per cubic meter
– air sample not collected at that location

[a] Round 1 samples collected July 22, 2010, during summer conditions.
[b] Round 2 samples collected on August 25, 26, or 27, 2010, following removal of caulk around exterior window frame.
[c] Round 3 samples collected on September 6, 2010, following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted.
[d] Round 4 samples collected on September 19, 2010, under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted.
[e] Round 5 samples collected on September 27, 2010, under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.
[f] Round 6 samples collected on September 29, 2010, under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles.
[g] Round 7 samples collected on October 18 and 19, 2010, under isolation, encapsulation and air cleaner configurations.
[h] Round 8 samples collected on November 4, 2010, under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[i] Round 9 samples collected on November 11, 2010, under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[j] Round 10 samples collected on November 20, 2010, under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[k] Round 11 samples collected on November 24, 2010, under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[l] Round 12 samples collected on December 2, 2010, under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.
[m] Round 13 samples collected on February 23, 2011, under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.

* PCB concentration analysis performed by Alpha Analytical Inc., using U.S. Environmental Protection Agency (EPA) Method 10A (GC/MS-SIM).
† Samples collected under minimum outdoor air delivery.
‡ Sample collected with supplemental air outdoor air (1,200 cubic feet per minute).

A graphical summary of the PCB concentration measured in indoor air at Estabrook between July 22 and February 23, 2011, is provided in Figure 1. Indoor air PCB levels measured during Round 13 were approximately 6-fold lower than in Round 1. Similarly, a 2-fold decrease in average concentrations has been achieved since winter ventilation conditions began in late September. These observations continue to demonstrate the effectiveness of the mitigation methods employed in Estabrook.

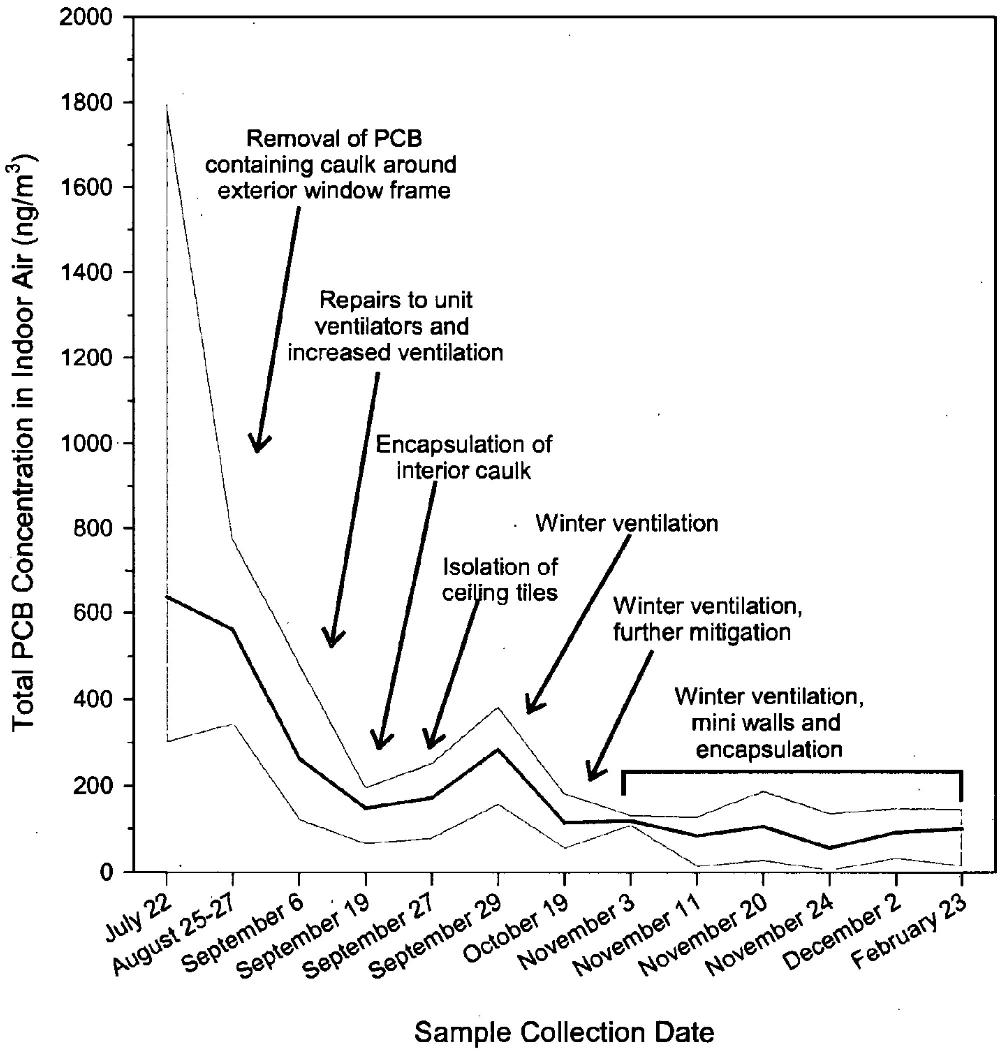

Figure 1 Average (line) and Range (shaded area) of Total PCB Concentration in Indoor Air over Time

If you have any questions regarding this memorandum please do not hesitate to contact us at 1-800-TALK EHE (1-800-825-5343).